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Reliability and Maintainability

Assessment Report

For

Laser Scanner Image Generation System

Link Report No. 1029

Prepared For

Naval Training Equipment Center

Orlando, Florida 32813

Under

Contract No. N61339-74-C-0039 New

By

Singer/Link Division

Binghamton, New York 13902

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The data presented herein constitutes a complete and accurate account of the procedures, criteria and conclusions associated with the Reliability and Maintainability Assessment performed on the Laser Scanner Image Generation System.

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Abstract

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1.0 INTRODUCTION

1.1 Scope

This document sets forth the procedures, criteria and conclusions associated with the Reliability and Maintainability Assessment for the Laser Scanner Image Generation System.

1.2 Application

This document is applicable to Contract N61339-74-C-0039, Item 0026, Reliability Demonstration. The equipment subject to evaluation is defined as Item 0003, Laser Scanner Image Generation System.

1.3 Associated Documents

The following documents were utilized to develop this report:

1.3.1 Specifications

NTEC Specification 222-1183 dated 5 November 1979	Specification for AH-IS (Cobra) Flight Simulator, Device 2B38

1.3.2 Standards

MIL-STD-757	Reliability Evaluation from Demonstration Data
MIL-STD-785A	Reliability Program for Systems and Equipment
MIL-STD-721B	Definitions of Terms for Reliability, Maintainability, Human Factors and Safety

1.3.3 Other

Singer-Link Document	Procedure for 12 day Reliability and Maintainability (RAM) Assessment, Laser Scanner Image Generator Product Development Program Rev. A, 11-26-80

Other (cont'd)

LR-979	Laser Scanner Image Generator System Study Final Report 28 November 1979

1.4 Definitions

Definitions of terms used throughout this document are those of MIL-STD-721B.

1.5 Abbreviations/Symbols

SPD	Simulation Products Division of Singer
NTEC	Naval Training Equipment Center
MTBF	Mean-Time-Between-Failure
MTTR	Mean-Time-To-Repair
LSIG	Laser Scanner Image Generation

2.0 TEST OBJECTIVES

The objective of the 12 day assessment was to evaluate the reliability/maintainability potential of the LSIG, specifically with regard to operational availability. Data accrued on the breadboard system concerning those design characteristics influencing operational availability - reliability, stability, and maintainability - was to be combined with data from operation during the development period and vendor data to accomplish this objective.

To the extent possible, parametric estimates were to be developed and compared to the design goals established in para. 3.1.2(3) of the Link S.O.W.

3.0 DESCRIPTION OF TEST ITEM

The LSIG has been described in detail in section 1.3 of the LSIG system study final report LR-979. The breadboard system used in the development program was the test item evaluated during the 12 day period. Block diagrams of the breadboard LSIG and Laser table are provided in Figure 1 and Figure 2.

The laser table as designed is an optical bench used for producing and mixing the outputs of three lasers to provide a "white light" beam consisting of four major laser lines. In addition to the conventional red, green, and blue laser lines, it was found that a fourth, "yellow" line is necessary for high-fidelity color reproduction. The red is obtained from a krypton laser, the green and blue from an argon laser, and the yellow from a dye laser pumped with the excess green light emanating from the argon laser.

4.0 ASSESSMENT CONDITIONS

4.1 Assessment Location and Schedule

The assessment was conducted at Librascope, Glendale, California. It commenced on 1 December 1980 and was completed on 12 December 1980.

4.2 Procedures

The assessment was conducted in accordance with the Reliability and Maintainability Test Procedures. The procedure is included as Appendix A of this report.

4.3 Environmental Conditions

The assessment was conducted under normal operating conditions of the test facility. These conditions are as follows:

Lab ambient air:	Temp	70 ± 2	typical
	Humidity	55 ± 15%	typical

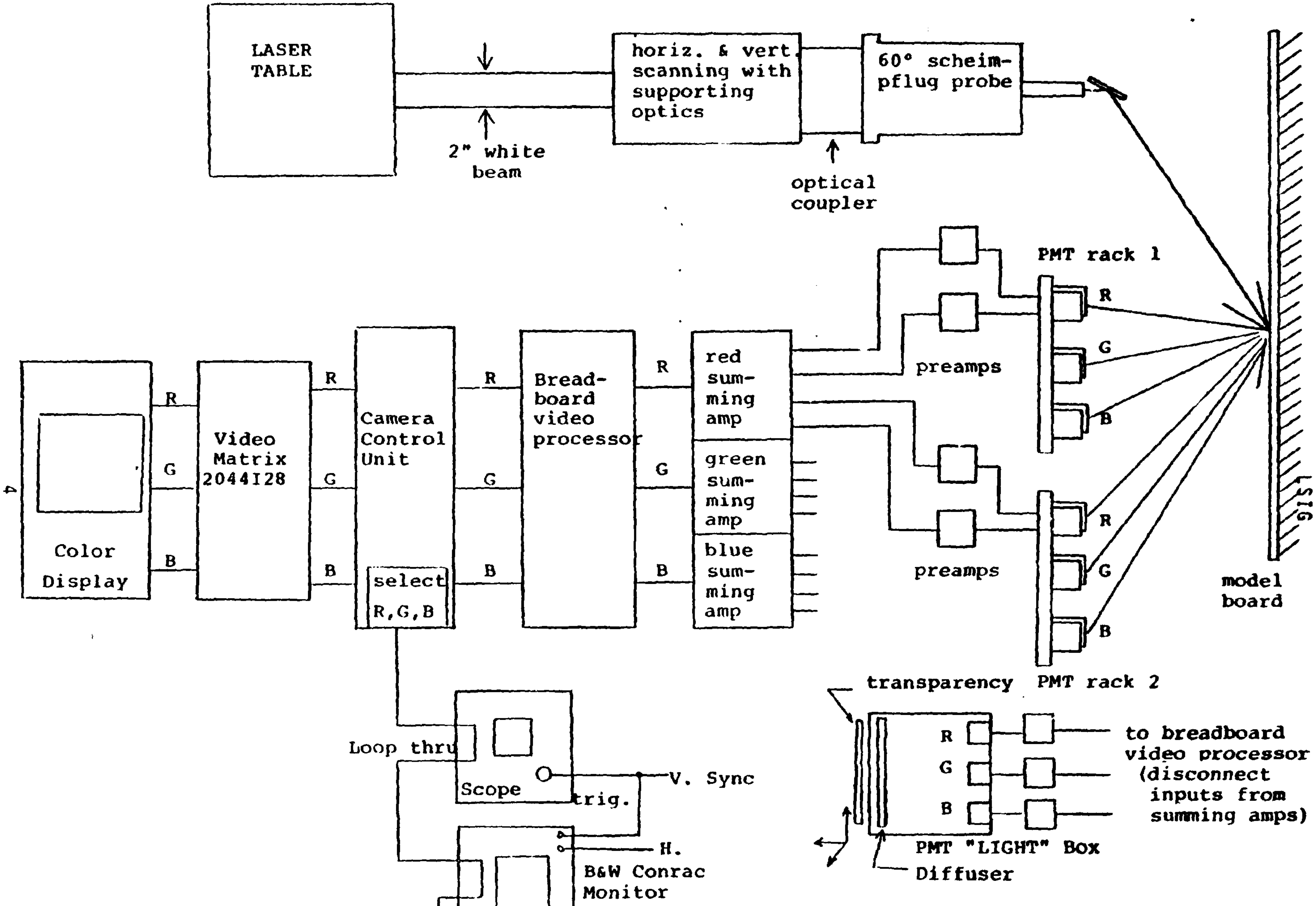


FIGURE 1
Breadboard LSIG System Block Diagram

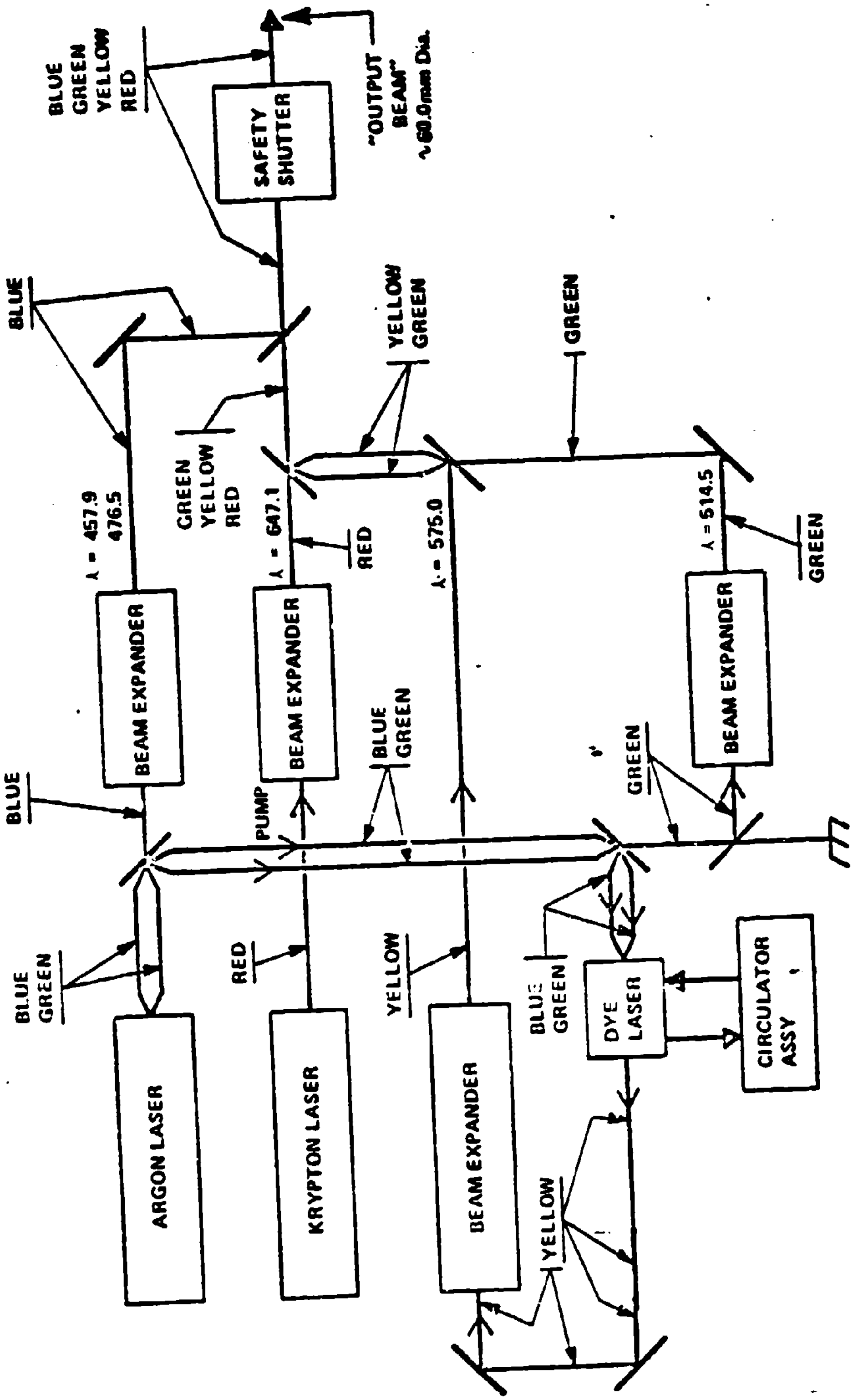


FIGURE 2

Breadboard Laser Table

Laser table air:	Laboratory Ambient Filtered (95% atmospheric Particles Removed) 235 CFM Flow Rate
Laser cooling : (Plasma tube and power supply)	Water, closed loop system 60^{o}F @ 45 PSIG (Argon) 60^{o}F @ 30 PSIG (Krypton)
Electrical: Power	Commercial, unconditioned

4.4 Equipment Operation

Equipment operation was scheduled for a period of 12 days with a 2 day break after the first 5 days of testing. The daily test cycle consisted of a 16-hour period with the system at full power and a 8-hour period with the system off. System performance parameters, including power output levels of the lasers, video levels of the red, green and blue channels, field of view centering, color registration of the system, and system resolution were measured and recorded periodically during the 16 hour period.

4.5 Maintenance

The Laser Scanner system was routinely operated and maintained by Librascope Engineering personnel. Spectra-Physics and Lexel personnel provided technical assistance on an as needed basis, including a visit to the test facility by Spectra-Physics and via telephone (see results discussion).

All maintenance actions, including adjustments, were documented.

4.6 Support Equipment

No support equipment, other than that utilized to perform normal maintenance and test of the system was required during the assessment. This equipment consisted of the following:

5 Channel Probe Servo Director	Singer Test Fixture C4154
Photo Multiplier Test Box	Singer Test Fixture
Test Transparency	Singer Test Fixture
50 MHZ Oscilloscope (2)	Tektronix Model 454
Volt-Ohm-Milliammeter	Triplett Model 630-T-APLK #30152
Power Meter, 0-10 Watts	Coherent Radiation Model 210 #2929

5.0 TEST RESULTS

The breadboard LSIG system accrued a total of 115.5 operational hours over 10 operational days (12 calendar days).

Appendix B of this report contains the official log of the assessment. The data from the assessment has been organized into three broad categories as follows:

1) System stability
2) Critical failure modes
3) Parametric estimates

5.1 System Stability

System stability was, for assessment purposes, evaluated with respect to the capability of the system to commence operation on schedule and to operate within tolerances without frequent maintenance.

The system was able to commence operation at the desired time (generally 0700) 40% percent of the time. Argon laser problems and the unavailability of a replacement laser during the first week of test were significant factors inhibiting system readiness.

The impact of the 8 hour power-off period produced alignment problems, which on several occasions caused delays in commencing operation. The exact cause of the change in alignment has not been determined but it is believed to be related to thermal stability of the laser table, since the breadboard table is extremely sensitive to temperature change. The typical temperature differences between the end of the day and turn-on was 2-3^{o}. Limitations in the ease of alignment of the breadboard system also contributed significantly to delays in the morning. In general, however, delays were 90 minutes or less.

Stability on the whole, after operation commenced, was good. The ability of the breadboard to operate within tolerance is portrayed in Figure 5 through 12. These graphs were developed from the measurement data on the logs. The ambient temperature and humidity graphs, Figures 3 and 4 respectively, are included for reference because of the previously defined interaction with the breadboard alignment.

Color registration (no graph developed) was typically less than 2 arc minutes, and worst case was 8 arc minutes. Note that the implied specification at turn-on was $\pm$8.4 arc minutes in the central circle (.8 picture height diameter) with degradation during operation to $\pm$21.2 arc minutes permissable.

Field of view centering (no graph developed) was rated fair. Although some drifting was observed, drift was usually less than 7 arc minutes vertically and 10 arc minutes horizontally with a worst case drift of 20 and 50 arc minutes respectively. The auto image correlation feature of final design and the beam angle servo will correct this problem.

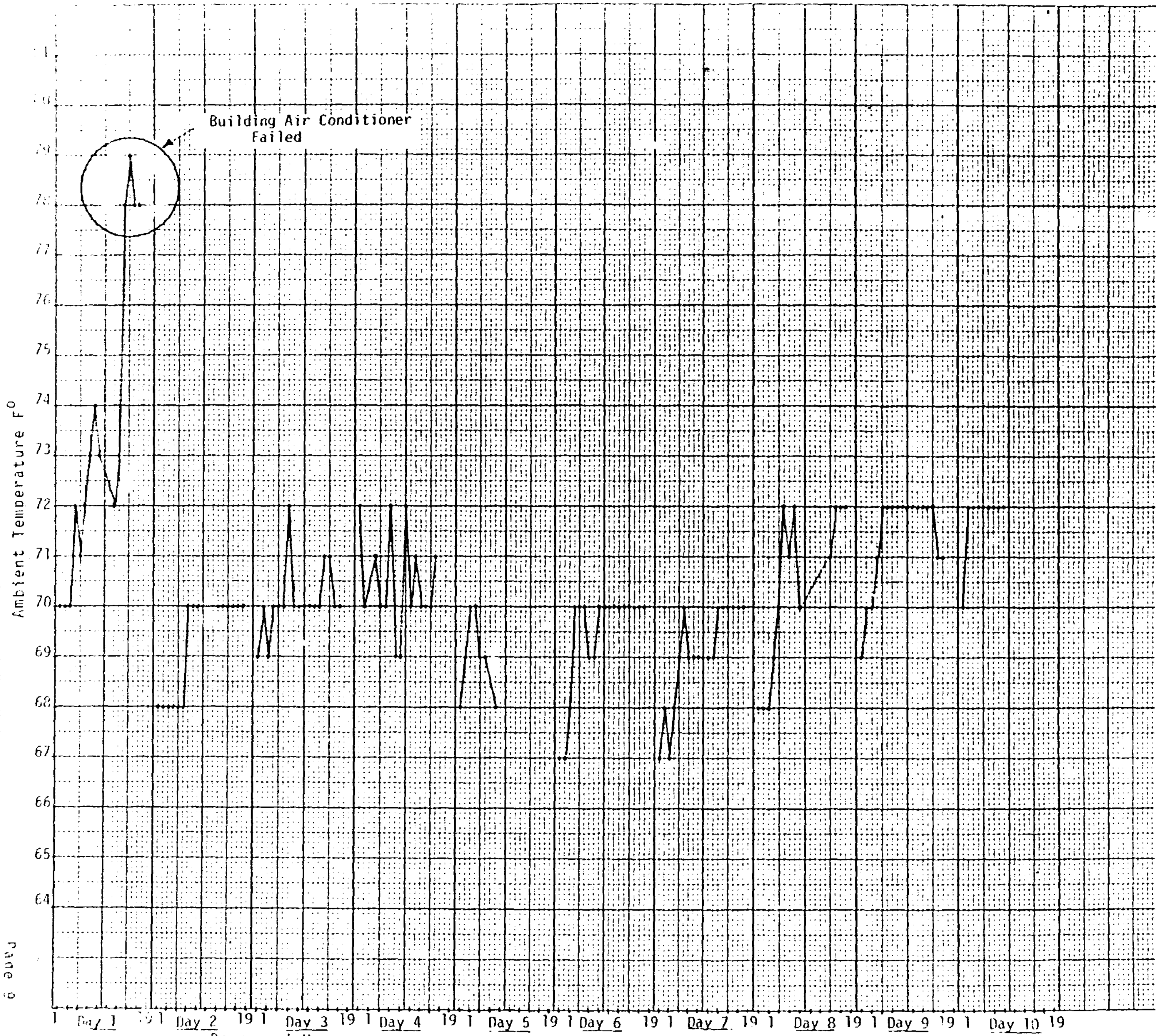


Figure 3 Ambient Temperature

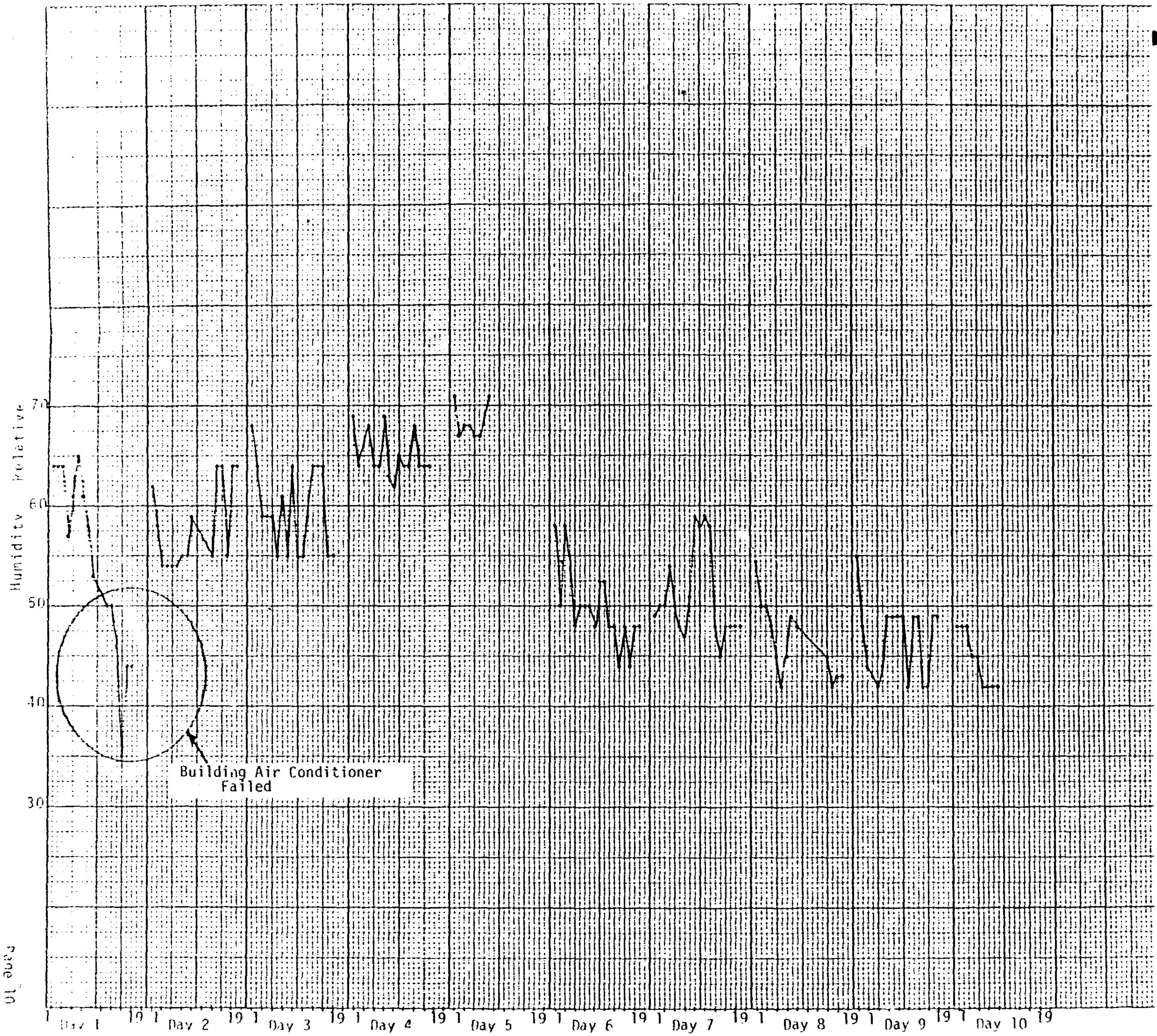


Figure 4 Humidity

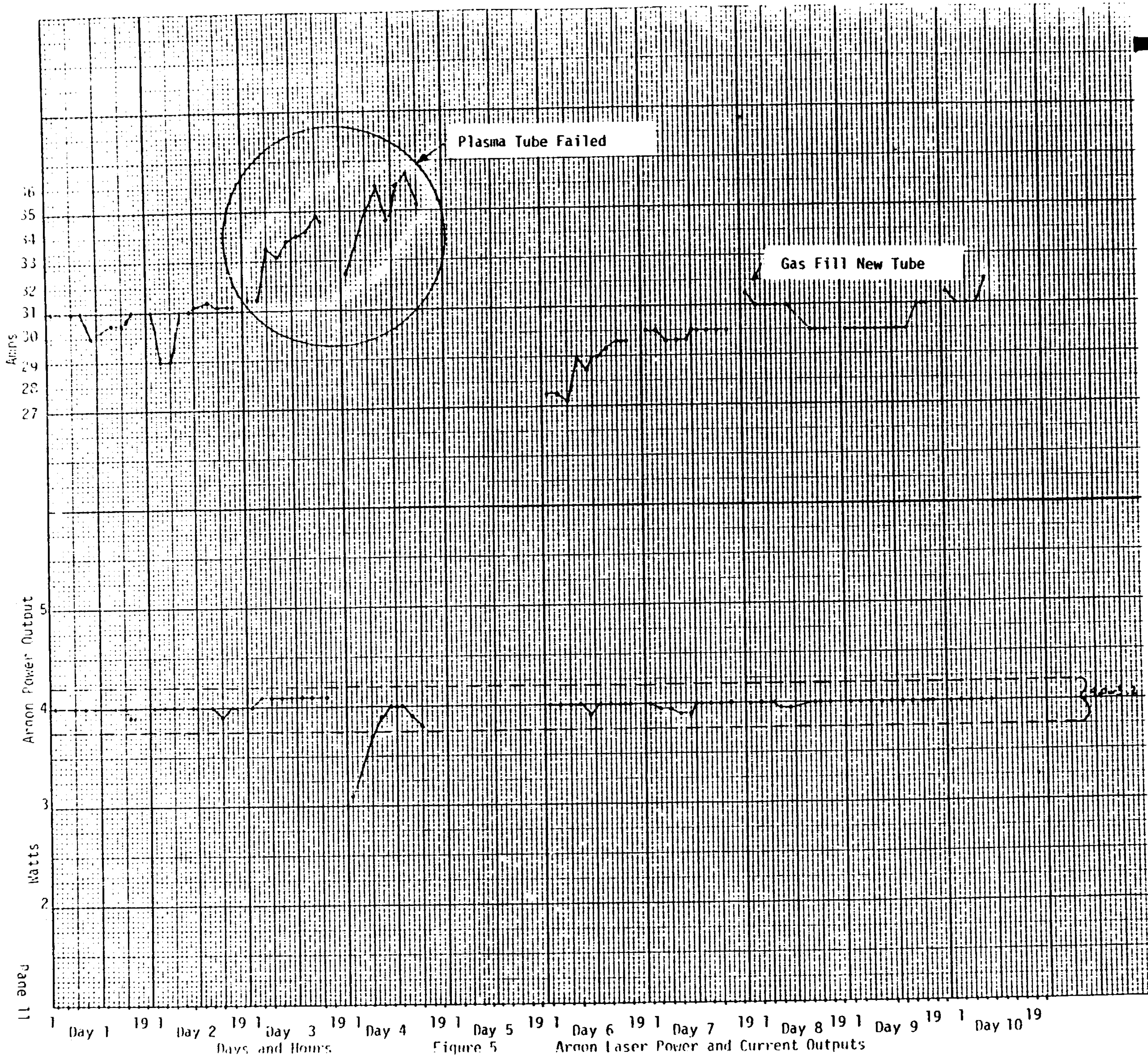


Figure 5 Argon Laser Power and Current Outputs

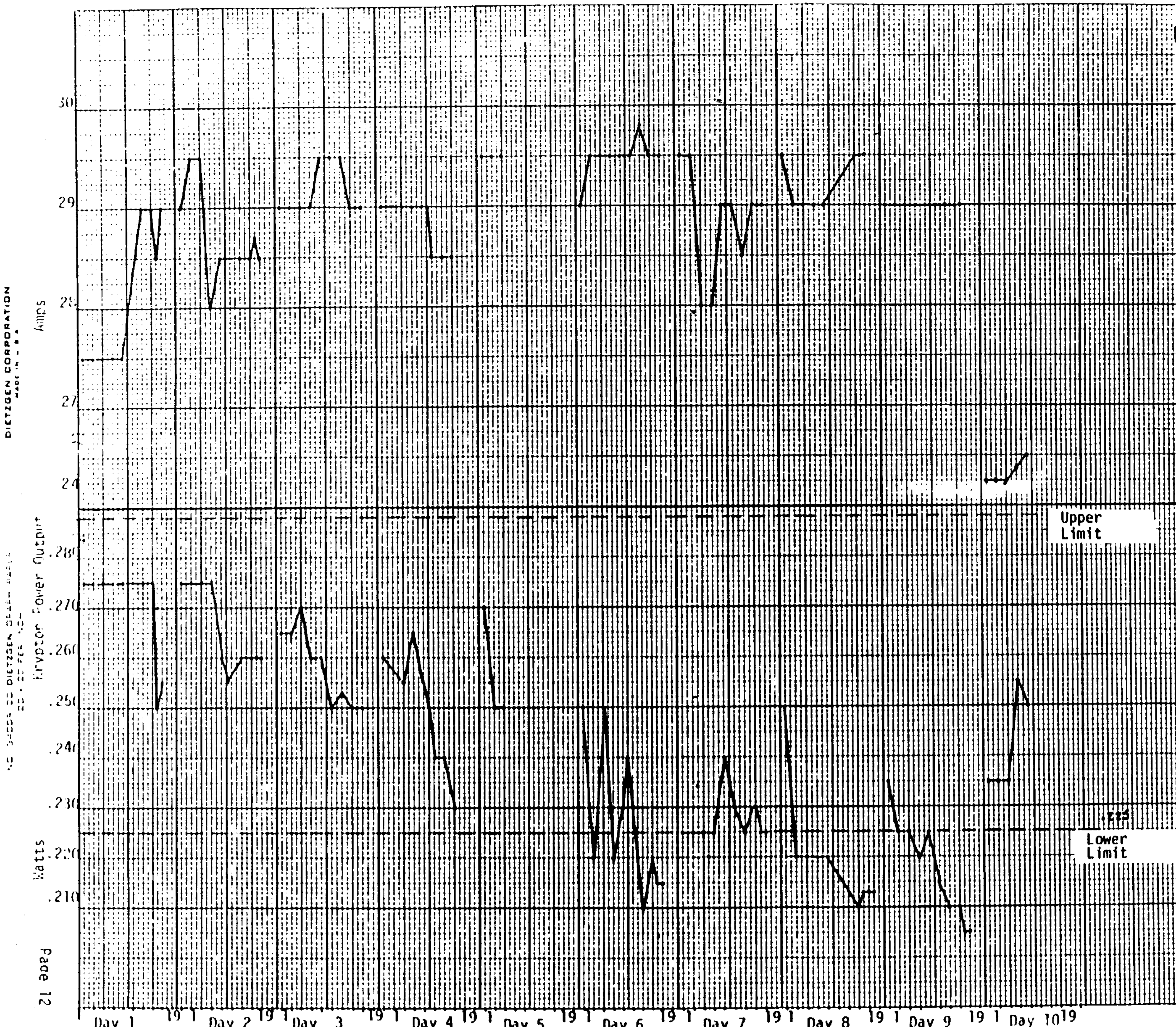


Figure 6 Red Laser Power and Current Outputs

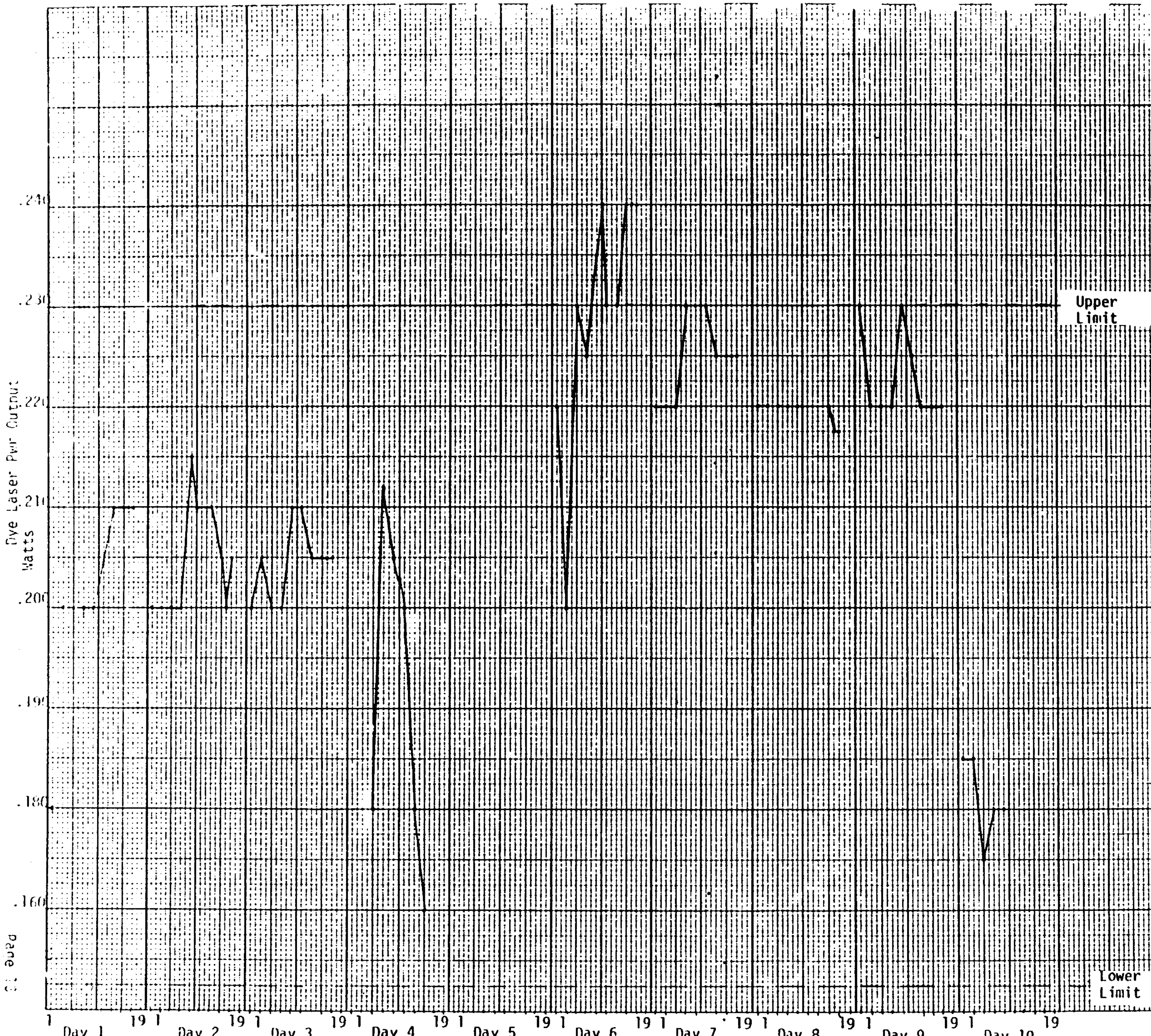


Figure 7 Dye Laser Power Outputs

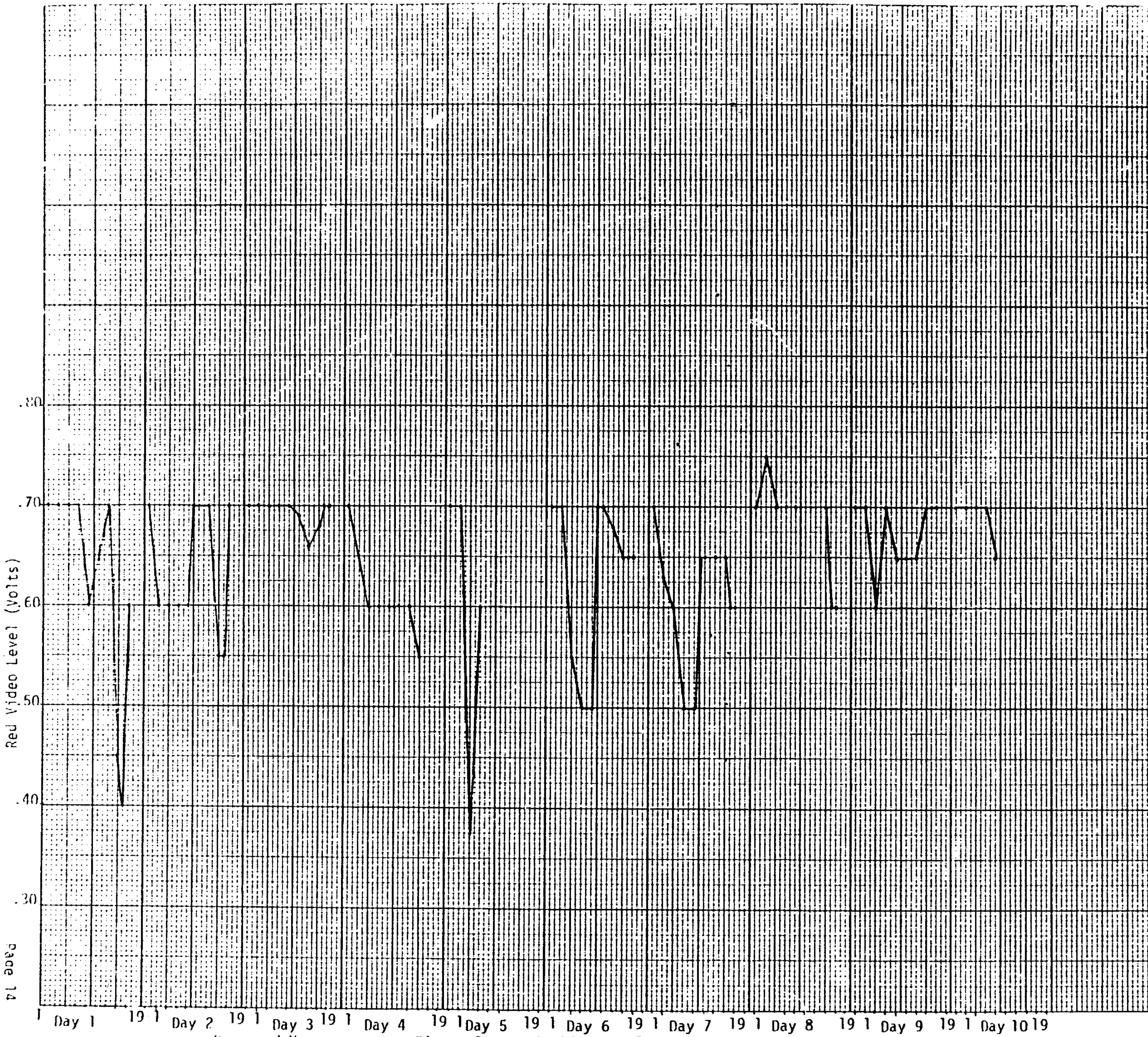


Figure 8 Red Video Levels

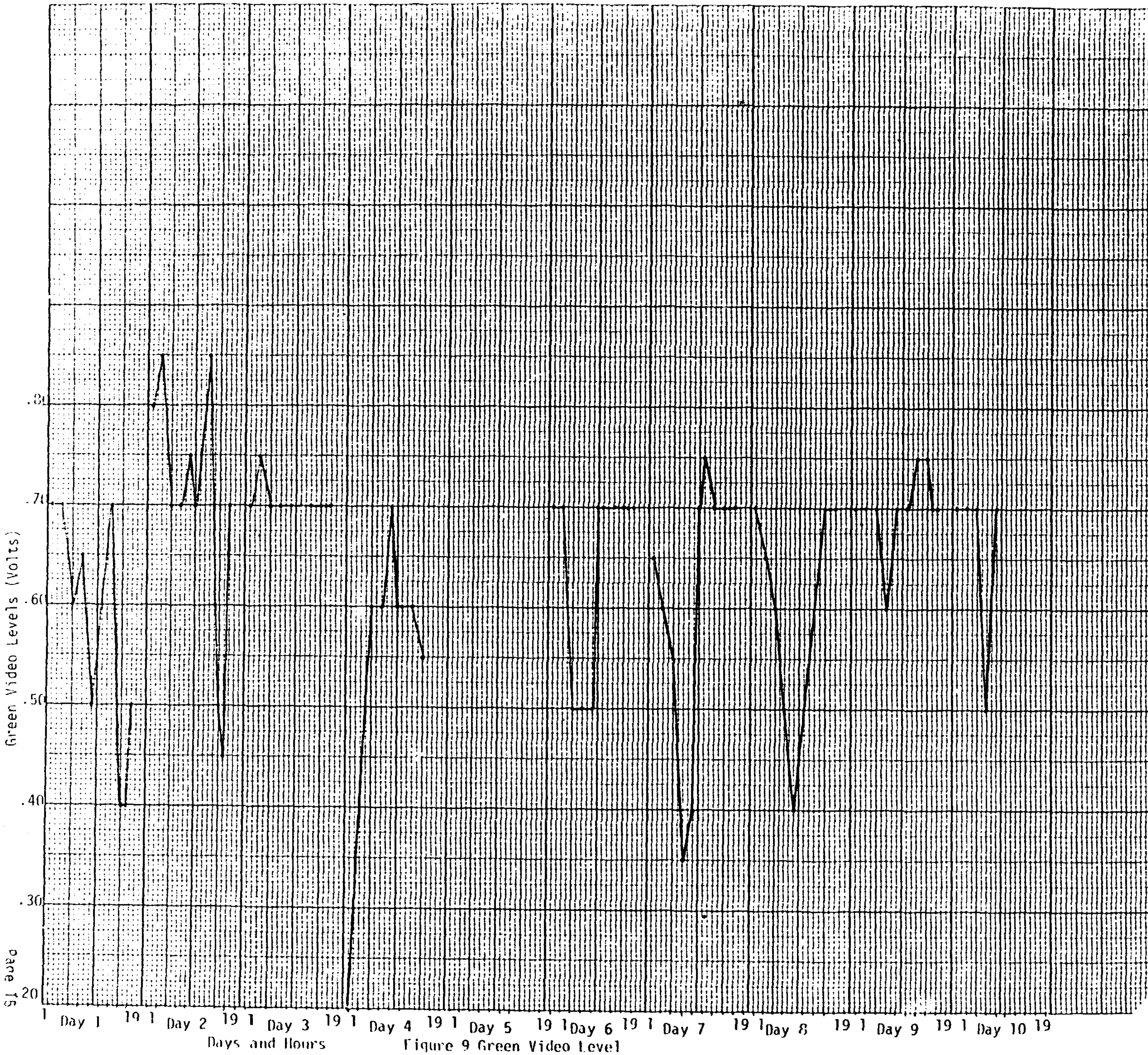


Figure 9 Green Video Level

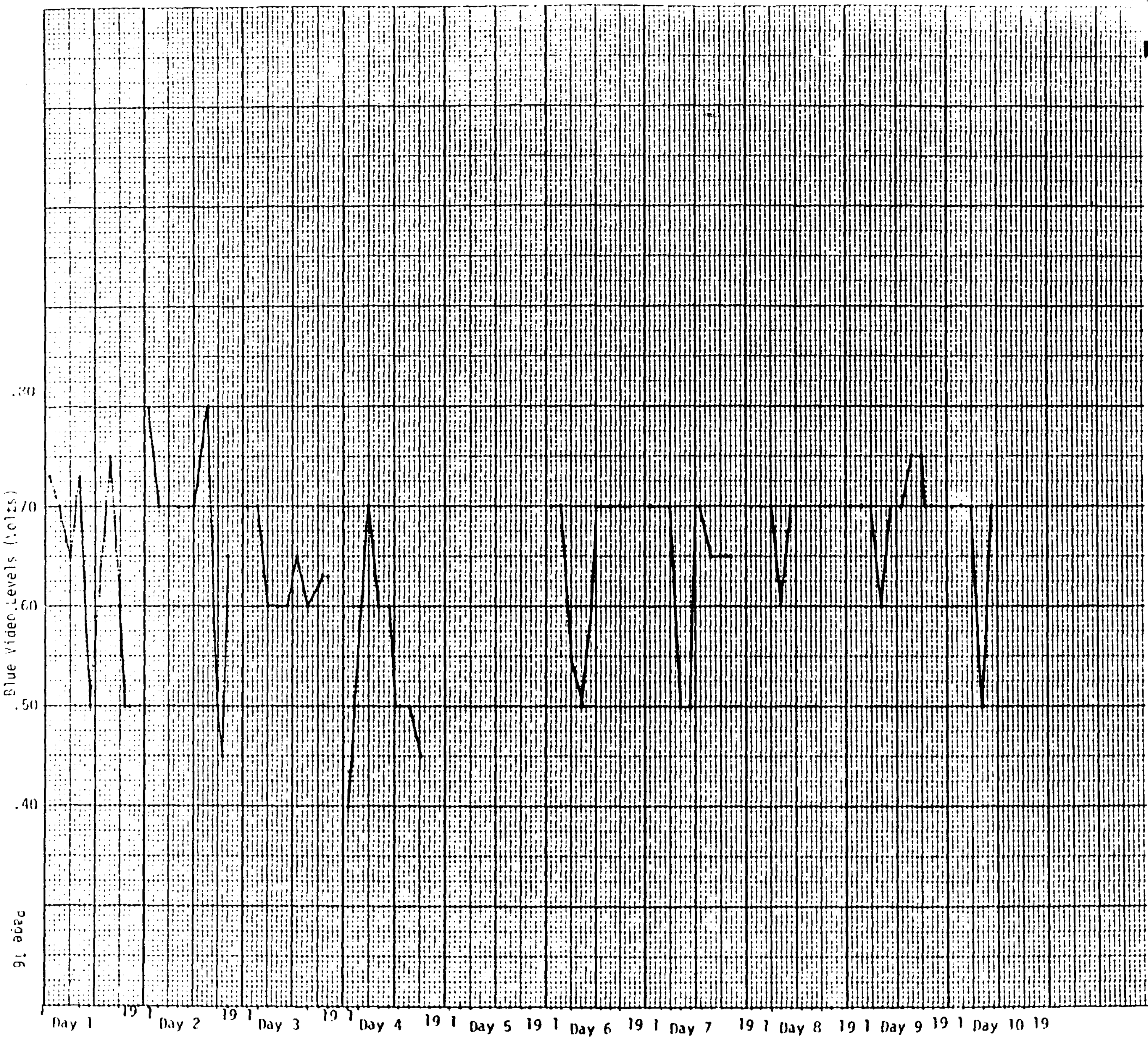


Figure 10 Blue Video Levels

Figure 11 Vertical Resolution

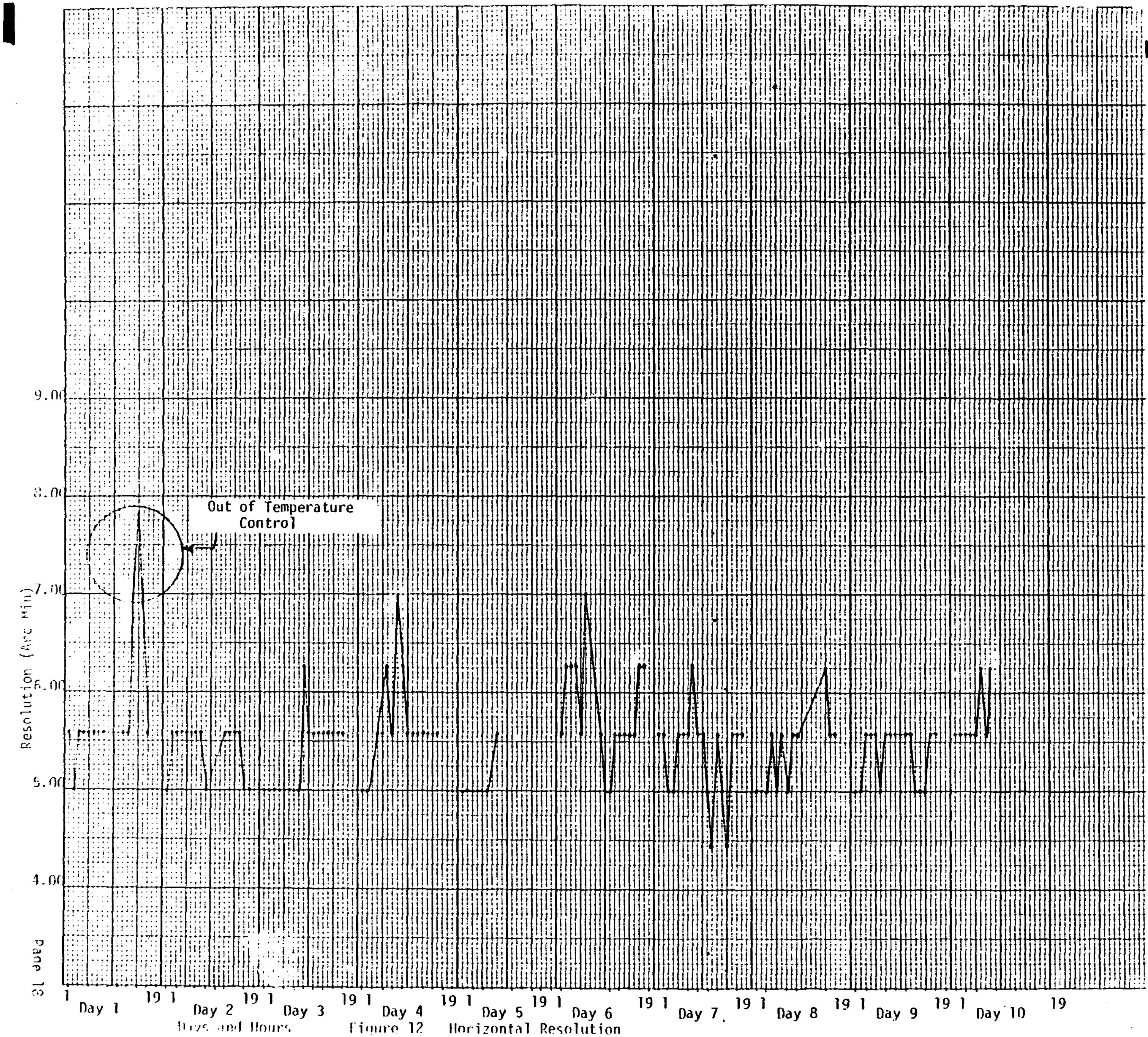


Figure 12 Horizontal Resolution

Laser power output (see Figures 3, 4, and 5) was very good except when attributable to equipment failure. The Lexel Krypton laser, which was last aligned in June of 1980 during factory refurbishment, exhibited some graceful degradation in output. Re-alignment of the laser, on the final day of test, was the only laser power adjustment of the entire assessment other than during the fault isolation and replacement of the Spectra-Physics Argon laser.

Note that the yellow dye laser is "pumped" by a portion of the Argon laser output and is therefore dependant. The dye laser output, Figure 7, is influenced by table alignment and the power outputs of the Argon laser, Figure 5. The dye laser output correlates with the output levels of the Argon laser as can be seen in the Figures.

Video levels, Figures 8, 9, and 10, were also generally good, but exhibited more drift than any of the other parameters monitored. In reviewing this data, it should be noted that the electronics were not gain stabilized, a deficiency corrected in the proposed final design.

The nominal video output is 0.7 $\pm$ 0.1 volts. The green video level fell within the desired range approximately 80% of the time. Red video level was within the desired range approximately 90% of the time, and the blue was within limits 85% of the time.

Video level is impacted by laser output, optical path alignment (in particular the top periscope mirror, and PMT pre-amplifier gain). The catastrophic failure of the Argon laser is apparent in the graphs. Routine restoration of video levels was accomplished by adjustment/alignment of the following:

PMT Pre-amplifier gain

Blue-Green-Yellow Dichroic mirrors (laser table)

Top Periscope mirror (optical input to scanner)

The top periscope mirror was the most critical, both in terms of the frequency of adjustment and the impact upon video output. Beam displacements attributable to alignment shifts of this mirror, through vibration or temperature effects, was addressed in the breadboard design. A beam angle servo design exists in the scanner support optics. Mechanical design deficiencies and dead zone characteristics of the photo sensor utilized limit the effectiveness of the system to low frequency, large amplitude alignment shifts. A candidate photo sensor with significantly better resolution is under study for application in the final design. The improved sensor and improvements in mechanical design are expected to provide a much improved beam angle servo system and improved video level stability.

Resolution throughout the assessment was good. Horizontal resolution in particular was consistently 7.0 arc minutes or better. Vertical resolution was less stable, but was generally 7.0 arc minutes. Resolution of less than 7.0 arc minutes was experienced for 11 hours of operation, with a worst case of 8.77 arc minute resolution.

The performance described above was accomplished primarily in a "hands-off" mode. The plan was to make adjustments as needed after 8 operational hours (even days) or 16 operational (odd days). This procedure was adhered to except when unscheduled maintenance due to equipment failure or serious performance degradation made continued operation impractical. Such unscheduled maintenance was discouraged to provide as much information as possible on the stability of the system. It is significant, however, in assessing the impact of the data upon the availability potential of the final design, to consider that most adjustments to improve performance could have been accomplished on-line, without interrupting operation.

Specific maintenance actions and frequency of maintenance are discussed in Section 5.3 Parametric Estimates of this report.

5.2 Critical Failure Modes

Five hardware problems were experienced during the assessment. These problems are summarized below:

Spinner electronics (intermittent)
Spinner air supply (facility)
Argon laser power supply relay
Argon laser rear cavity mirror
Argon laser plasma tube

5.2.1 Spinner Electronics Intermittent

An intermittent associated with circuit card 220 caused a loss of spinner synchronization and resulting automatic shut down of the spinner. Attempts to resolve this problem during the assessment, including replacement of the connector, were not completely successful and a spare card was not available. Subsequently, a poor solder joint at a potentiometer was located and corrected. Although a total of 16 such dropouts occurred, all occurred within the first 4 days of test, including 4 in a 15 minute period. This problem is believed to be caused by the poor solder joint on the circuitry of the breadboard Speedring 220 card. This particular problem is a classical electronic equipment problem, and is not unique to the LSIG design concept. It is believed that the production version of these electronics, will effectively minimize such occurrences. (It should also be noted that the spinner protective circuitry operated as intended - it consistently sensed the problem and shut the spinner down).

5.2.2 Spinner Air Supply

During the final day of test, the external air compressor which supplies air to the spinner assembly failed. The loss of pressure was sensed and the system safely shut itself down.

The pump is an oil-less design, and it is suspected that the teflon rings in the pump wore out. The system has been in service for approximately three years. Failure analysis of the pump has not been completed, but the failure is not uncharacteristic of teflon rings. The failure is within the compressor and is of the type expected of this class of electro-mechanical equipment. The mode of failure is absolutely unrelated to its application on the LSIG.

Repair of the pump in a brief period was not feasible, so the spinner was operated using Nitrogen gas as the bearing instead of air. System operation is not degraded using Nitrogen, indeed Nitrogen offers superior dryness and cleanliness with respect to air. Operation of the system using Nitrogen is constrained only by the supply and spinner consumption rate of 125 cubic feet per hour at 165 PSI.

5.2.3 Argon Laser

The Argon laser proved to be the most troublesome component of the entire system. After operating for approximately 1200 hours (including two days of the assessment period) the laser output fell below the 4 watts required. Inspection of the rear cavity mirror revealed a small spot, believed to be a burn at the beam impact area. Cleaning the mirror and rotating the burn spot out of the beam impact area was not successful. Laser alignment and increasing plasma tube current from 30.5 to 33.5 amperes produced 4 watts maximum (laser rated at 5 watts). The laser operated for approximately 15 hours without further incident. The following mornings, laser power at turn-on was 3.1 watts. The rear cavity mirror was replaced, a capacitor in the power supply replaced (at the suggestion of Spectra-Physics) and the laser realigned. Maximum power output attainable was 3.9 watts at a current of 36 amperes. Operation commenced at that level and continued for approximately 12 hours at which time the laser failed completely. Unavailability of a replacement precluded operation the following day, Friday December 5, 1980.

Spectra-Physics personnel replaced the plasma tube Saturday afternoon. A relay in the power supply, which had not failed, but which was considered marginal, was also replaced and the system was powered up and aligned to specification and shut down for the weekend.

The system operated very well for the following two days of test. On Wednesday, video levels degraded and could not be restored through optical path alignment or video amplifier gain adjustment.

It was observed that low gas pressure alarm in the Argon laser supply was activiated. The gas pressure in the plasma tube was increased to the proper level via the key operated pressurization system in the supply. An automatic tube pressure monitor prevents overfilling. Operation of the laser at rated power was immediately restored.

Investigation of these events yielded the following:

(1) Because of the deterioration of the plasma tube and the ineffectiveness of the rear cavity mirror replacement upon the laser output, it is uncertain that the original mirror failed. A minute spot, suspected as caused by a dust particle incinerated by the laser beam on the mirror surface was observed, but not confirmed as adversely effecting operation.

(2) Preliminary analysis by Spectra Physics indicates the pressure of the argon gas in the plasma tube was too high. The increased pressure requires a supply voltage in excess of that attainable with the breadboard system. Cause of the increased pressure has not been confirmed, but the failure investigation is centering upon the solenoid operated gas fill valve. Spectra-Physics has recorded previous fill valve failures but such failures are infrequent (less than 1% of field returns) and are not considered to be a problem with this design.

(3) The need to raise the internal pressure of the noble gas within the plasma tube is a result of entrapment of some of the gas in the walls of the bore in operation. This phenomenon is well understood and the gas reservoir and filling provisions of the laser supply are incorporated to ensure an adequate supply of gas for 5000 to 10,000 hours of operation.

5.3 Parametric Estimates

The breadboard LSIG is essentially a development system, intended to prove viability of the design concept.

Significant design differences exist between the breadboard and the proposed production system. Such differences as a single gas laser instead of the two in use on the breadboard, improvements in the laser table configuration with improved thermal stability error detection and improved alignment capabilities, beam angle servo compensation, etc., are discussed in detail in the Engineering Report prepared by Link. These differences, and the comparatively short duration of the assessment, precludes drawing any strong conclusions regarding either the quantitative reliability and maintainability characteristics of key components (such as the plasma tube) or the production configuration of the LSIG itself. Despite such differences, sufficient conceptual and hardware similarities exist to generate considerable interest in those parameters impacting operational readiness and logistic resources. Accordingly, estimates of several parameters have been developed.

Parameter	Estimated Value
Power-on hours[1]	
Breadboard LSIG System	283
Spinner Assembly	320
Argon Laser	297
Krypton Laser	316
Dye Laser	318
Operational Availability[2]	72%
Scheduled Hours	160
Operational Hours	115.5
Unscheduled Maintenance Actions[3]	27 (9)

LSIG

Parameter	Estimated Value
Mean-Time-Between-Maintenance[4]	4.25 (10.5) hours
Mean-Time-Between-Failure[5]	
Breadboard LSIG System	14 (94) hours
Spinner Assembly	18.8 (160) hours
Argon Laser	99 (297) hours
Krypton Laser	316 hours
Dye Laser	318 hours
Mean-Time-To-Repair	2 - 4 hours typical
Frequent Adjustments/Alignments	
Top Periscope Mirror	
Laser Table Dichroic Mirror	
PMT Pre-amplifier Gain	
Laser Table Beam Pointing Mirror	
Typical Alignment Time (System)	60 minutes

1. Includes 172 hours on the lasers and 165.45 hours on the spinner assembly during the period October 9th through November 11th. No failures occurred.
2. Assumes a hypothetical schedule of 16 hours/day commencing at 0700. Delays in commencing operation were treated as lost time. Computed as the ratio of achieved operation to scheduled operation. Includes logistic delay time (no spares available at Librascope).
3. Parenthetic figure excludes spinner dropouts to illustrate significant impact this one problem had on calculations.
4. Includes scheduled adjustments and alignments. Parenthetic figure excludes spinner dropouts.
5. Parenthetical figures consider the spinner electronics intermittent as one equipment problem, and exclude the argon laser power supply relay and rear cavity mirror replacements on the premise that the cause of failure was the plasma tube fill valve, not these items.

6.0 Conclusions

During the assessment period, there were numerous maintenance actions. The nature and frequency of these actions produced an initial disappointment in the system's performance. It soon became apparent, however, that the majority of these maintenance actions were associated with design limitations of the breadboard and its support facilities. In this regard, the lessons learned from the breadboard have been very beneficial and will continue to influence the design of the production system. Specific design areas which require improvement follow:

(1) Beam stability. The laser table, and optical path stability, should be improved through better matching of thermal coefficients. An improved beam angle servo is needed to provide automatic error correction.

(2) PMT pre-amplifier gain. Automatic gain control is necessary. This feature has been incorporated in the production design.

(3) Fault Isolation/alignment. The existing breadboard table has rudimentary alignment provisions and reference points. Extended maintenance times resulted from the inadequate provisions for alignment. Additional delays were frequently introduced because of the absence of reference points to aid fault isolation. Corrective action was based upon technician experience and trial and error. Improvements must be incorporated to facilitate maintenace by less highly skilled personnel and to reduce alignment times.

(4) System Dependability. A better understanding of the effect of power-off periods on the optical path alignment is required. Cause of morning start-up problems

must be identified and incorporated in the design.

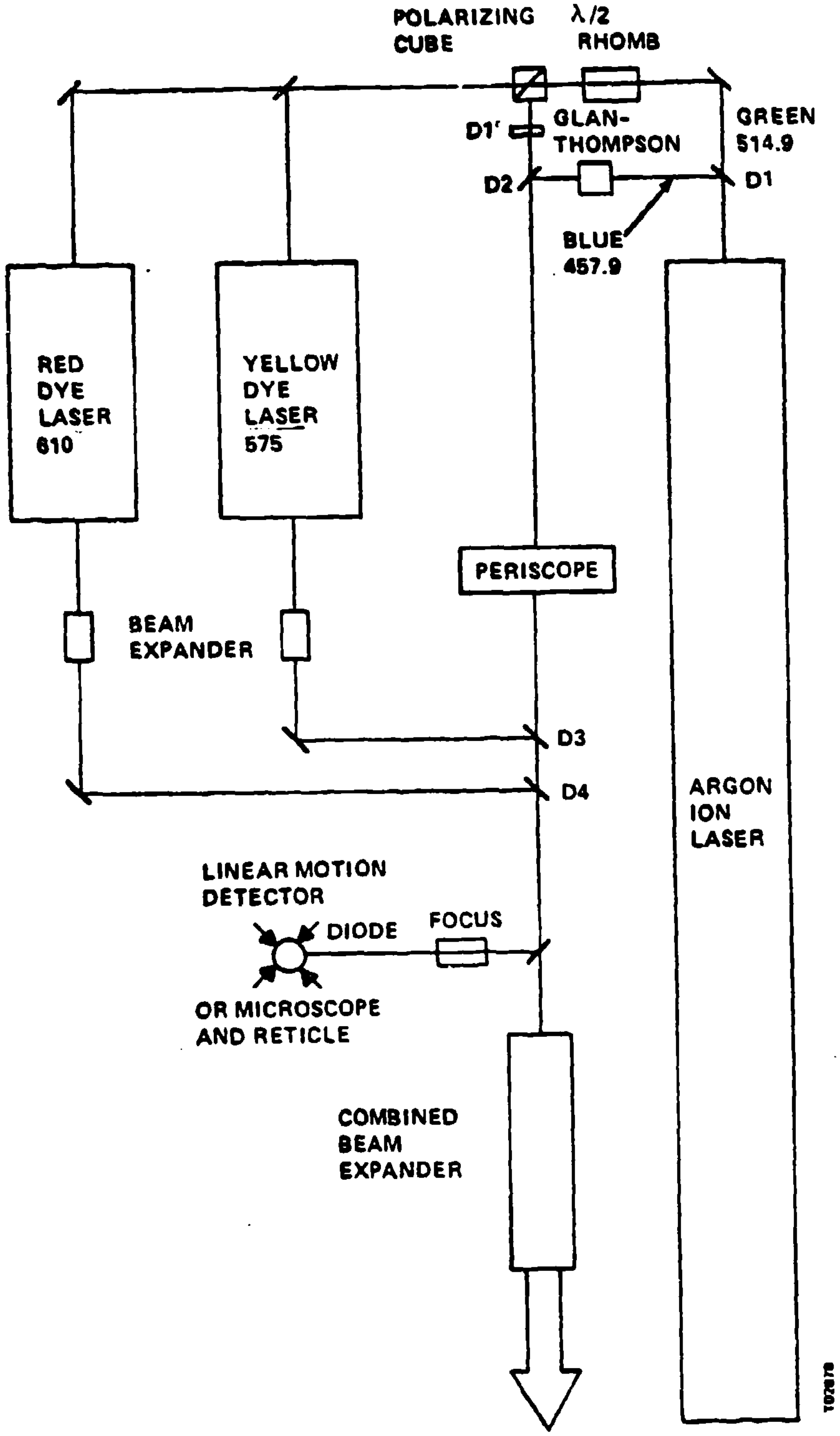
(5) Supporting facilities. It is very apparent that control of the laser table environment cannot be treated lightly. The production design must carefully address temperature control, air cleanliness and water temperature, cleanliness and flow rate.

(6) Spinner Electronics. The breadboard electronics packaging should be ruggedized. The card bin support structure does not provide sufficient card support, and is not acceptable for installation on the Y tower.

The preceding design concerns are solvable and are not in conflict with the basic design approach. Indeed, the proposed production design has addressed these concerns. Figure 13 depicts the production laser table configuration. The table provides the following advantages with respect to the breadboard:

(1) Improved reliability - one gas laser and two dye lasers offer inherent advantages with respect to the breadboard configuration of two gas lasers and one dye laser. The more efficient optical design also permits operation of the laser at power levels well below those of the breadboard. The derating permitted by these low power requirements provide a potential for extended laser life.

(2) Fault Isolation/alignment - provisions to monitor the beam alignment have been incorporated (re: Figure 13 - linear motion detector or microscope and reticle). Alignment of each color beam is individually adjustable via



PROPOSED LASER TABLE CONFIGURATION

FIGURE 13

beam splitter (Green via D1, Blue via D2, Yellow via D3, and Red via D4).

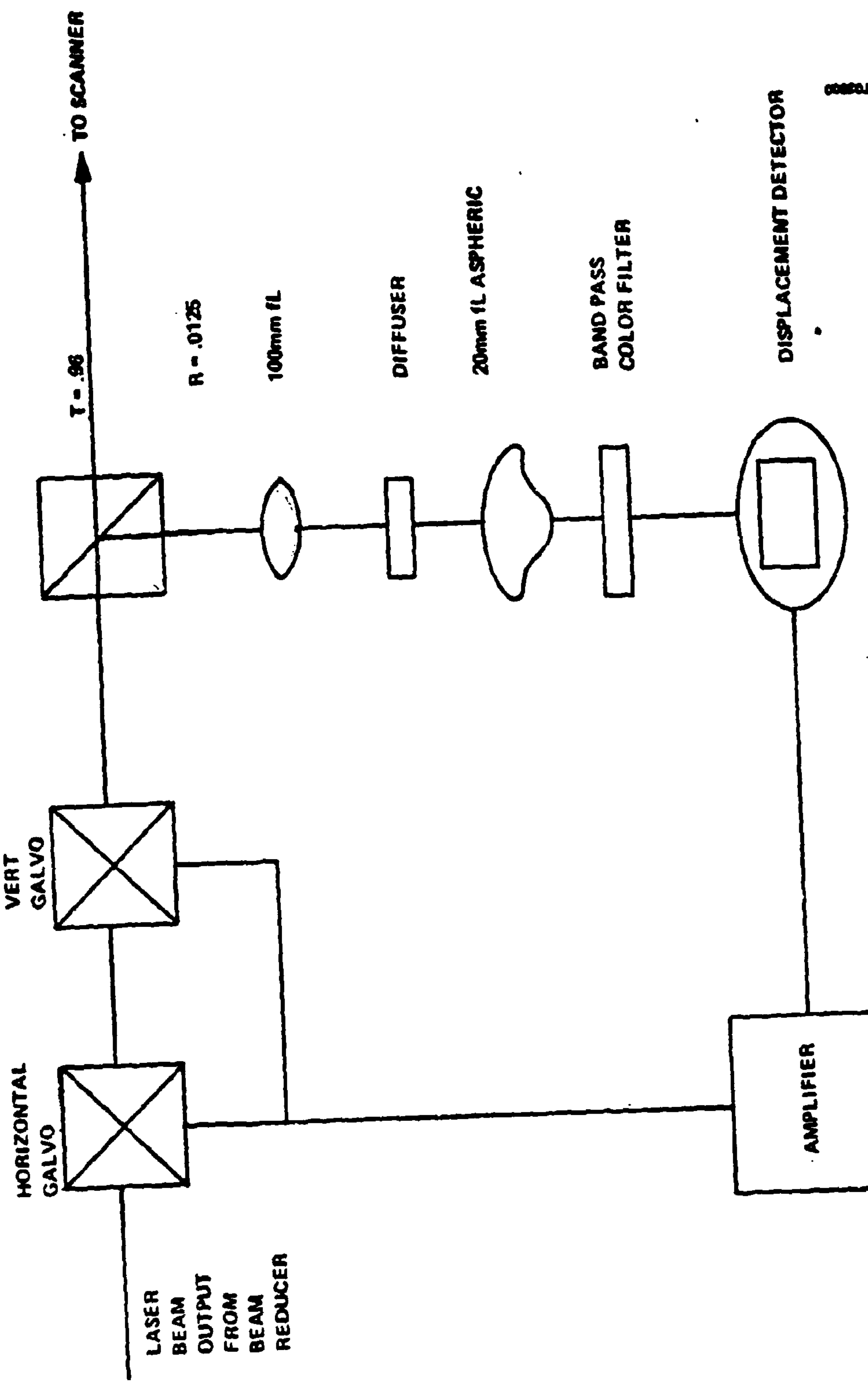
Other production system improvements include improved beam stability. The laser table itself is designed to be more thermally stable, and the beams are combined before expansion. This latter technique significantly reduces performance degradation resulting from beam drift. Additionally, a beam angle servo has been included at the spinner input, and is an improved version of the breadboard design. Figure 14 illustrates the proposed servo design. (A lateral servo is also under consideration, and will be added, if necessary, at the laser table output).

PMT pre-amplifiers will provide automatic gain control circuitry. The drift experienced on the breadboard system from this source will therefore be elminated. The PMT banks will also include built-in-test circuitry which will permit rapid monitoring of each individual PMT on a daily basis via switches and LED displays.

These improvements are indicative of how the design concerns of the breadboard LSIG have been addressed in the production design.

It is significant that the breadboard, despite its deficiencies, confirmed that 16 hour per day operation with good visual performance is feasible. With its improvements, the production design has the potential for excellent operational readiness.

No conclusion relative to laser life is possible. Previous projections of laser life can neither be confirmed nor refuted. Further evaluation of life data and failure mechanisms is necessary. However, data from the manufacturer, including failure mode information,



BEAM CORRECTION SERVO

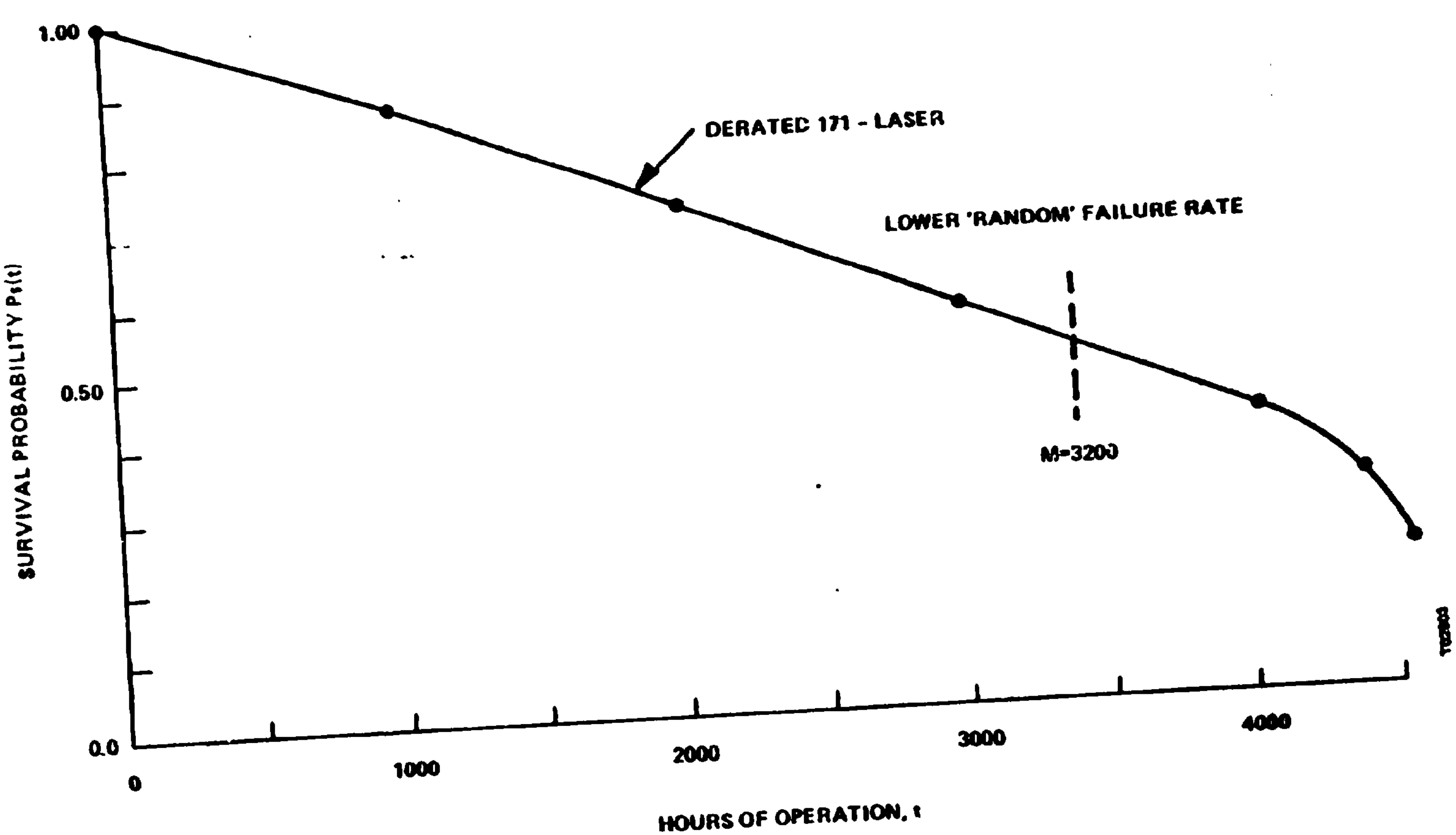
FIGURE 14

indicates a life of 3000-4000 hours in the LSIG application environment to be a realistic expectation. The manufacturer of the laser, Spectra-Physics, has, after reviewing the LSIG application, extended the warranty to 2000 hours. the price of the unit, including extended warranty, is therefore based upon a single plasma tube with an expected mean life of greater than 2000 hours. Figure 15 depicts survival probability (life) as a function of operating time. Laser life is addressed in more detail in the engineering report.

The impact of the LSIG upon the overall 2B33 visual system reliability and maintainability cannot be quantified on the basis of this assessment data. The design differences between the breadboard and production design and the brief evaluation period prevent direct extrapolation of assessment data to the 2B33 LSIG. Predicted data using classical reliability procedures are considered a best estimate, particularly for comparison purposes. The prediction for the 2B33 CMS visual system* was updated to reflect the LSIG configuration as defined in the engineering report. This analysis has been completed and the following table summarizes the reliability and maintainability parameters obtained in addition to comparing corresponding subsystems of each configuration from a reliability/maintainability viewpoint:

* Reference Maintainability Status Report 2B33-3.19, 20 July 1979.

REASONABLE EXPECTATION - NEAR TERM



LASER LIFE EXPECTANCY

FIGURE 15

LSIG

	CMS System $\lambda/10^6$ hrs	MTTR	LSIG System $\lambda/10^6$ hrs	MTTR
Probe Installation	382	(45)	382	(46)
Image Generation	2942	(46)	1894	(50)
Model Installation	2455	(40)	2105	(40)
Switching/Weapons Effects	1217	(40)	1217	(40)
Display Installation	2264	(42)	2264	(42)
Cables/Miscellaneous	235	(45)	235	(45)
Linkage	745	(40)	745	(40)
λ =	10240		8842	
MTBF =	97.6		113.1	
MTTR =	42.5		43	

These updated classical predictions reflect a 15.8 percent improvement in reliability using the LSIG in lieu of the Camera Image Generator Hardware. It should be noted that in both CMS and LSIG analyses, light bank and PMT bank reliability and maintainability parameters were excluded from the calculations. In the case of the LSIG system, Link Reliability Engineering chose to exclude the associated failure rate data for the following reasons:

a) The probability of having no PMT site failures during a 16 hour training day is 97.8%.

b) The shadowing effect of failure of a single PMT site does not significantly degrade the system. (Re: discussion of this topic in the engineering report). The probability of having less than two PMT site failures is 99.954%.

c) The probability of having two adjacent PMT site failures (which would cause objectionable degradation) is 4.839×10^{-8}.

Since the probability of having two adjacent complete site failures (thus affecting a training mission) is so minute, the R/M values associated with the PMT bank were excluded from the classical analyses. Failed PMT hardware would be replaced on an "as needed" basis during the daily preventive maintenance period. All previous R/M analyses of the CMS system treated the light bank in the same manner.

The LSIG system also incorporates an Automatic Image Correlation System which has no counterpart in the CMS system. This system is described in detail in the engineering report, and is illustrated conceptually in Figure 16. Fiber optics with PIN diode sensors imbedded in the model board provide inputs to electronics which give active feedback for probe heading, pitch, and roll angles near airfields, target ranges and other designated areas. The system utilizes approximately 200 diode amplifier cards and associated electronics. The system has an MTBF of approximately 9000 hours, and when integrated into the 2B33 visual system with LSIG, results in a system MTBF of 100.3 hours. The overall MTBF, including the image correlation hardware, is 2.7% better than the CMS system without image correlation. In this instance, reliability was traded-off for improved maintainability and system performance. The image correlation system, in addition to improving visual performance in such areas as weapons effects, significantly reduces probe alignments, a frequent and time consuming task on the existing CMS design.

It is important to note that classical reliability analyses address catastrophic part failures only, and that other events such as wear out, drift, secondary failures, and maintenance induced errors result in a frequency of maintenance actions much higher than suggested by MTBF figures. The CMS for example, because of drift, requires

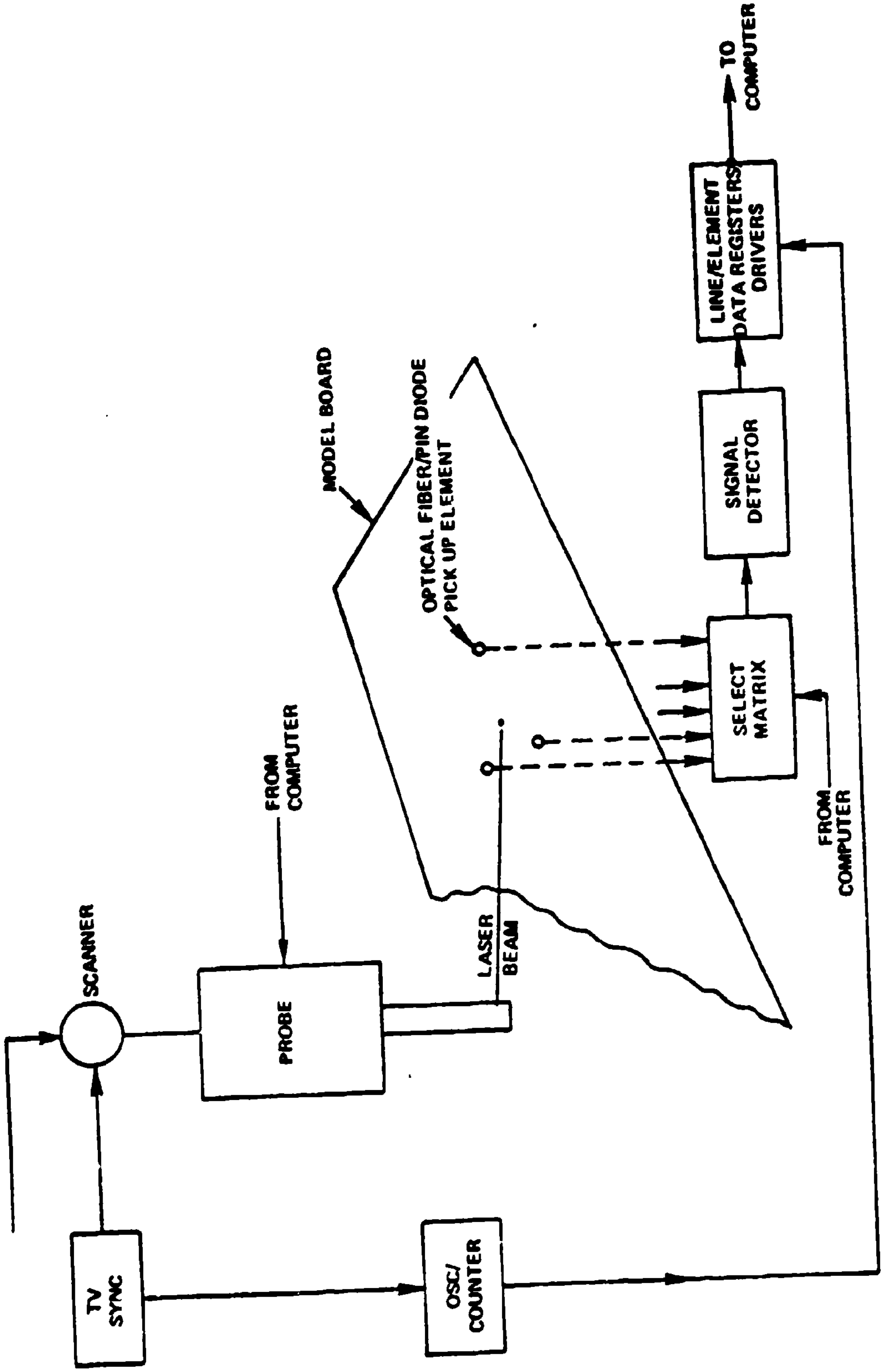


IMAGE CORRELATION SYSTEM BLOCK DIAGRAM

Figure 16

frequent adjustment and is, per OT&E data, exhibiting a mean time between maintenance actions of 3-4 hours. In this regard, the LSIG offers significant potential for improvement. The breadboard, despite its maintenance liabilities, exhibited a MTBM greater than 4 hours, and the improvements of the production design suggest a MTBM of 10 hours is feasible. Factors contributing to the reduced requirement for maintenance include:

a) Elimination of the hostile thermal environment including gradients over the model board, by eliminating the light bank.

b) Elimination of the camera and camera electronics. This equipment exhibits an inherent sensitivity to thermal effects significantly higher than that of the scanner electronics.

c) Provisions for automatic drift compensation via PMT amplifier AGC, beam position servo(s), and probe-image correlation. The latter feature eliminates one of the more frequent and time consuming probe alignment tasks of the CMS design.

The LSIG design is superior from a maintainability viewpoint to the CMS. Although statistical estimates of MTTR indicate no drastic difference between the two competing designs, the limitations of the analysis procedure (catastrophic failure only) understate the true maintainability advantages of the LSIG design. MTTR may in fact, not change significantly because of the much greater influence on that parameter of the non-image generator equipment, i.e., the image generator comprises approximately 20% of the total system hardware.

Maintenance manhours per operational hour and MTBM will be lower with the LSIG design than the CMS design.

Quantitative goals of 300 hours MTBF and 30 minutes MTTR were established for the LSIG. The proceeding discussion confirms that significant improvements in these parameters compared to the CMS have been attained, although the established goals were not. It should be noted, in assessing these parameters, that the image generation portion of the visual system represents approximately 20% of the total system, and that even if it were perfect, i.e., never failed, the total system MTBF and MTTR would not attain the design goals established.

The proposed LSIG design does offer the following:

a) improved visual performance

b) lower cost of ownership

c) increased reliability

d) lower frequency of maintenance

e) reduced alignment time

The transition from breadboard to production LSIG is a significant one. The engineering report and this document have addressed the technical objectives which must be accomplished in the production design. From a reliability and maintainability point of view, the objectives appear attainable with the proposed design.

Appendix A

RELIABILITY AND MAINTAINABILITY ASSESSMENT PROCEDURE

SINGER
LINK DIVISION
BINGHAMTON, NEW YORK

PROCEDURE FOR

12 DAY RELIABILITY & MAINTAINABILITY (RAM) TEST

LASER SCANNER IMAGE GENERATOR

PRODUCT DEVELOPMENT PROGRAM

REVISIONS	PREPARED BY (TYPE OR PRINT)	DATE	PREPARED BY (SIGNATURE)	DATE	CHECKED BY	DATE	APPROVED	DATE
ORIGINAL	P.J.Bellocchio	11/17/80	P.J. Bellocchio	11/17/80			[illegible]	11/19/80
REV.A	P.J.Bellocchio	11-26-80	P.J. Bellocchio	11/26/80			[illegible]	11/26/80

TABLE OF CONTENTS

FIGURES

REVISIONS

Revision A

Changed pages 5, 10, 14, 15, 16, 17, 18, 19, 20, 21, 22, 29, 30
31, 32, 33, and 34.

Added page ii.

1. SCOPE AND PURPOSE

This document describes the test procedure to be followed in conducting the 12-Day Reliability and Maintainability (RAM) Test on the LSIG demonstration hardware as required under the LSIG Development contract. The purpose of the test is to collect the necessary RAM data on the laser breadboard hardware under controlled operational conditions such that a RAM assessment can be made on the proposed final LSIG system design. Data collected during the 12 day period will supplement the reliability statistics from vendors of critical components, as well as RAM data collected on the breadboard system throughout the LSIG Development Program. Reliability and Maintainability predictions on the full-scale LSIG visual system will be made in analyzing such data, in conjunction with engineering analysis on the RAM aspects of the final design. Existing RAM data on system components common to both the camera-model system (CMS) and the laser scanner image generator (LSIG) will be used as much as possible. Sections 4 through 6 in this document details the daily tests. In addition, a maintenance log will be kept to record all scheduled and unscheduled alignment and repair performed during the test period.

2. APPLICABLE DOCUMENTS

a) Change Order No. P00023 to NAVTRAEQUIPCEN Contract N61339-74-C-0039.

b) "Technical Proposal for Laser Scanner Image Generation System Development Program", No. 1168, by Link, 7 March 1980.

c) "Specification for AH-IS (Cobra) Flight Simulator Device 2B33", 222-1183, by NTEC, 5 November 1979.

d) "Laser Scanner Image Generation System Study Final Report", LR979 by Link, Revised 28 November 1979.

e) "RAM Assessment Daily Test Procedures for Librascope - LSIG Product Development Program", by Link, 22 August 1980.

3. BREADBOARD SYSTEM CONFIGURATION

The breadboard system configuration is shown by the Block Diagram (Figure 3.-1) and by the Laser Table Schematic (Figure 3.-2).

4. DAILY PROCEDURES

The daily procedures to be followed are described in the sequence below. There will be 5 days (16 hr/day) of testing followed by one or two days off and then another 5 days (16 hr/day) of testing. The first day of testing shall be numbered day number 1 and each of the remaining test days shall receive a number in sequence. On odd numbered days the procedure in section 4.3 shall be run after turn-on and the morning readiness procedure have been completed. On even numbered days the procedure in section 4.4 shall be run. These procedures may be modified, if necessary, on site (with both Government and Link concurence) if the data generated at the beginning of the 12-day period indicated that a change to the procedures would generate more useful data to correlate with the actual operation of the intended simulator (production 2B33).

4.1 Turn-on and Warm-up

Turn the system on first thing in the morning and let it warm-up for 30 minutes. This warm-up time shall not count as part of the 16 hour day.

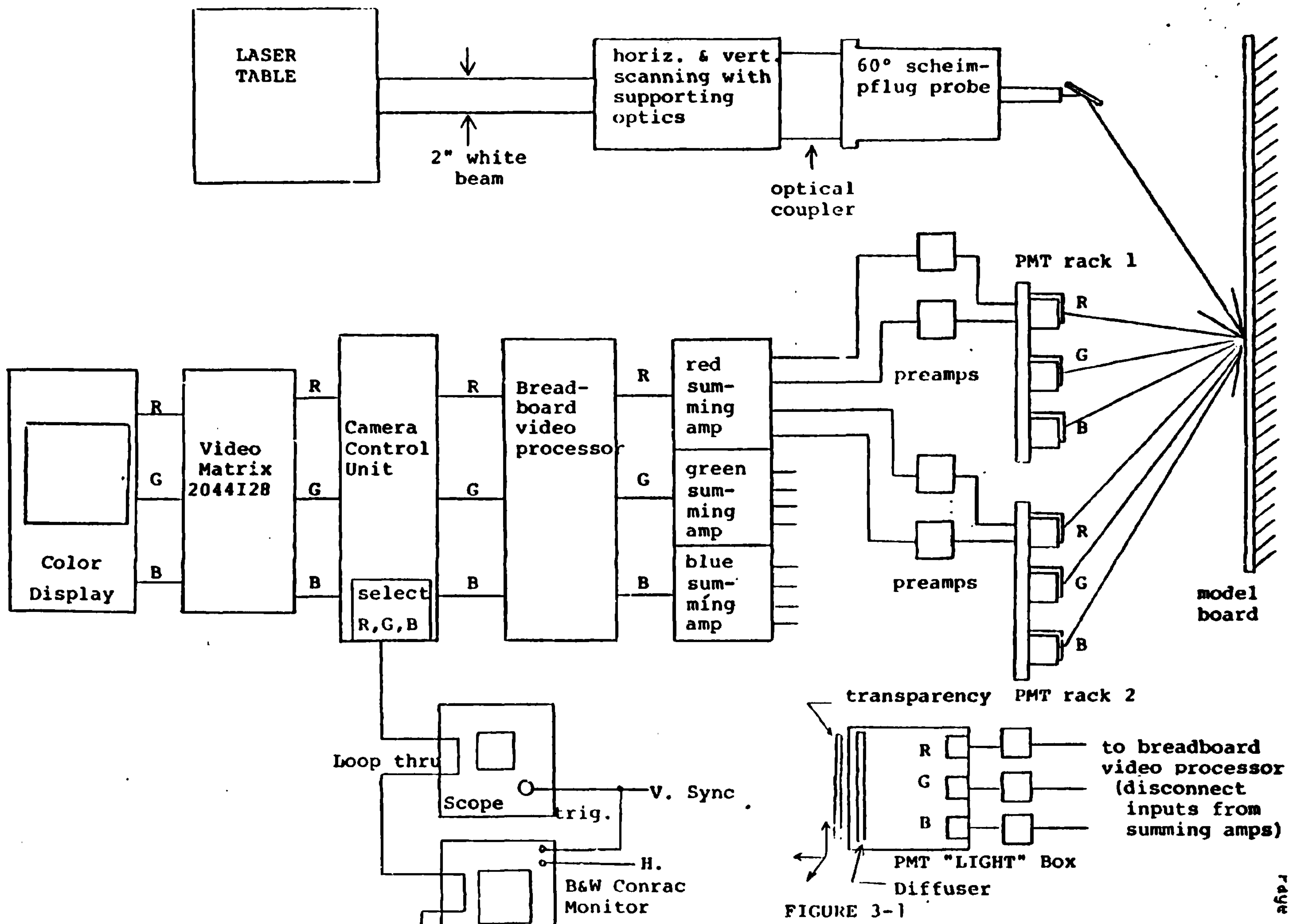
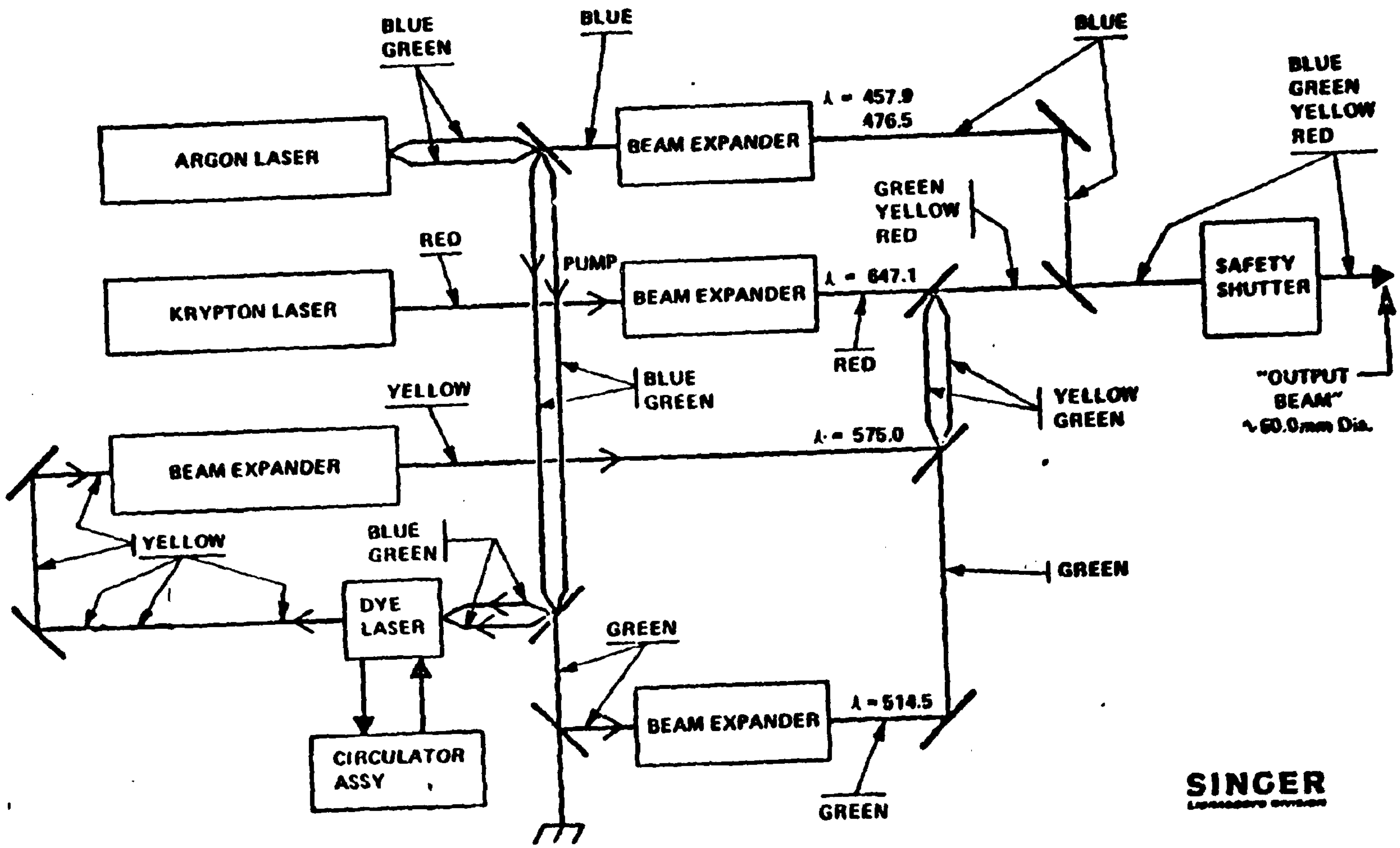


FIGURE 3-1

Breadboard System Block Diagram



SINGER

FIGURE 3.-2 BREADBOARD LASER TABLE

4.2 Morning Readiness Procedures

The following morning readiness procedures shall be performed sequentially after the 30 minute warm-up period and before the start of each day's tests:

a) Adjust, if necessary, the Argon and Krypton laser controller currents to yield the rated power output, as read on the controller's internal optical wattmeters in the case of the Argon laser and on an external optical wattmeter placed at the laser output in the case of the Krypton laser. Then adjust, if necessary, the dye laser for the rated power level measured at the output of the dye laser using an external optical wattmeter placed on the laser table. All three lasers should be kept in the TEM_{00} mode during these adjustments.

b) Check the sizing, centering and convergence of the color monitor paying particular attention to the convergence in the center of the CRT. Adjust if necessary.

c) Register the 4 laser beams together by adjusting the appropriate optical components on the laser table, if necessary.

d) Focus the 4 laser beams together by adjusting the beam expanders on the laser table, if necessary. This may affect registration - alternately adjust registration and focus until both are correct.

e) Adjust, if necessary, the PMT high voltage to yield a white signal level of 0.7 V in the red channel at the output of the breadboard video processor. Then adjust the blue and green gain of the Light Box preamps to yield a white signal level of 0.7 V in the blue and green outputs.

f) Check the vertical galvo deflection angle and centering. Adjust if necessary.

The time to perform these morning readiness procedures shall be counted as part of the 16 hour day.

4.3 Odd Day Procedure

Figure 4.3-1 shows the procedure to be followed on odd days. The intent of this procedure is to demonstrate reliability and maintainability over a 16 hour period and to determine the performance level of the system over a 16 hour period without any adjustments.

Therefore, do not make any adjustments to simply improve performance. The only adjustments allowed (other than probe servos) are those necessary to keep the system operational and these shall be recorded in Table 6-1 along with any failures that might occur. Adjusting of the probe in heading, pitch, roll and focus is allowed each time a test is run because the intent of this procedure is to determine performance of the laser system and not the performance of an existing piece of equipment (optical probe). Reliability data on the optical probe gathered on existing operational simulators will be used in the RAM analysis. The results of the hourly tests shall be recorded in Table 6-1. The tests referred to in Table 4.3-1 are described in section 5.

HOUR NO.	
	30 minute warm-up
1-	a. Perform morning readiness procedure b. Perform tests 5.2 thru 5.6
2-	Test 5.6
3-	Tests 5.6, 5.2, 5.3
4-	Test 5.6
5-	Tests 5.6, 5.2, 5.3, 5.4, 5.5
6-	Test 5.6
7-	Tests 5.6, 5.2, 5.3
8-	Test 5.6
9-	Tests 5.6, 5.2, 5.3, 5.4, 5.5
10-	Test 5.6
11-	Tests 5.6, 5.2, 5.3
12-	Test 5.6
13-	Tests 5.6, 5.2, 5.3, 5.4, 5.5
14-	Test 5.6
15-	Tests 5.6, 5.2, 5.3
16-	a. Perform Tests 5.6, 5.2, 5.3, 5.4, 5.5 b. Record any adjustments necessary to return system to max. performance using morning readiness procedure. c. Repeat tests 5.6, 5.2, 5.3, 5.4, 5.5 d. Shut-down at end of Hour No. 16
17-	

KEY:

5.2 Power Output
5.3 Video and Pedestal
5.4 Centering and Size
5.5 Color Registration
5.6 System Resolution

FIGURE 4.3-1 ODD DAY PROCEDURE

F-398-8-C

4.4 Even Day Procedure

Figure 4.4-1 shows the procedure to be followed on even days. The intent of this procedure is to demonstrate reliability and maintainability over a 16 hour period and to determine the performance level of the system over a 16 hour period with one adjustment period allowed after 8 hours - i.e., the end of the first 8 hour shift during a simulator's 16 hour training period.

Therefore, the adjustments allowed to simply improve performance are to be made only at the designated adjustment period. The only other adjustments allowed (besides probe servos) are those necessary to keep the system operational and these shall be recorded in Table 6-2 along with any failures that might occur. Adjusting of the probe in heading, pitch, roll and focus is allowed each time a test is run because the intent of this procedure is to determine performance of the laser system and not the performance of an existing piece of equipment (optical probe). Reliability data on the optical probe gathered on existing operational simulators will be used in the RAM analysis.

The results of the hourly tests shall be recorded in Table 6-2. The tests referred to in Table 4.4-1 are described in Section 5.

4.5 Shut-Down

Shut the system off during hours outside of the warm-up and operational test periods indicated above.

HOUR NO.

30 minute warm-up

1- a. Perform morning readiness
   b. Perform te[illegible] 5.2 thru 5.6

2- Test 5.6

3- Tests 5.6, 5.2, 5.3

4- Test 5.6

5- Tests 5.6, 5.2, 5.3, 5.4, 5.5

6- Test 5.6

7- Tests 5.6, 5.2, 5.3

8- Test 5.6

KEY:

5.2 Power Output
5.3 Video and Pedestal
5.4 Centering and Size
5.5 Color Registration
5.6 System Resolution

9- a. Perform tests 5.6, 5.2, 5.3, 5.4, 5.5
   b. Then record any adjustments necessary to return system to maximum performance using morning readiness procedure.
   c. Repeat tests 5.6, 5.2, 5.3, 5.4, 5.5

10- Test 5.6

11- Tests 5.6, 5.2, 5.3

12- Test 5.6

13- Tests 5.6, 5.2, 5.3, 5.4, 5.5

14- Test 5.6

15- Tests 5.6, 5.2, 5.3

16- a. Perform tests 5.6, 5.2, 5.3, 5.4, 5.5
   b. Then record any adjustments necessary to return system to max. performance using morning readiness procedure.
   c. Repeat tests 5.6, 5.2, 5.3, 5.4, 5.5
   d. Shut down at end of Hour No. 16

17-

FIGURE 4.4-1 EVEN DAY PROCEDURE

5. TESTS

The following tests shall be run during the periods designated in Paragraphs 4.3, and 4.4. The specification referred to in the "Applicable Spec. Paragraphs" section of each test is item (c) of Paragraph 2. of this document

5.1 "Light" Box Set-Up

All of the following tests make use of the test chart shown in Figure 5.1-1 and the Photomultiplier Tube (PMT) "Light" Box shown schematically in the lower right hand corner of Figure 3-1. The PMT Light Box contains three PMT's with red, green and blue filters, three preamplifiers, diffuser screen(s) and a test chart transparency holder capable of being moved in X, Y, and Z.

The tests are such that once the Light Box and Test Chart are set-up, all of the tests can be run without any further set-up. The single test chart contains all the information necessary to perform the five tests.

Therefore, one general set-up procedure is given in the following table which is common to all five tests.

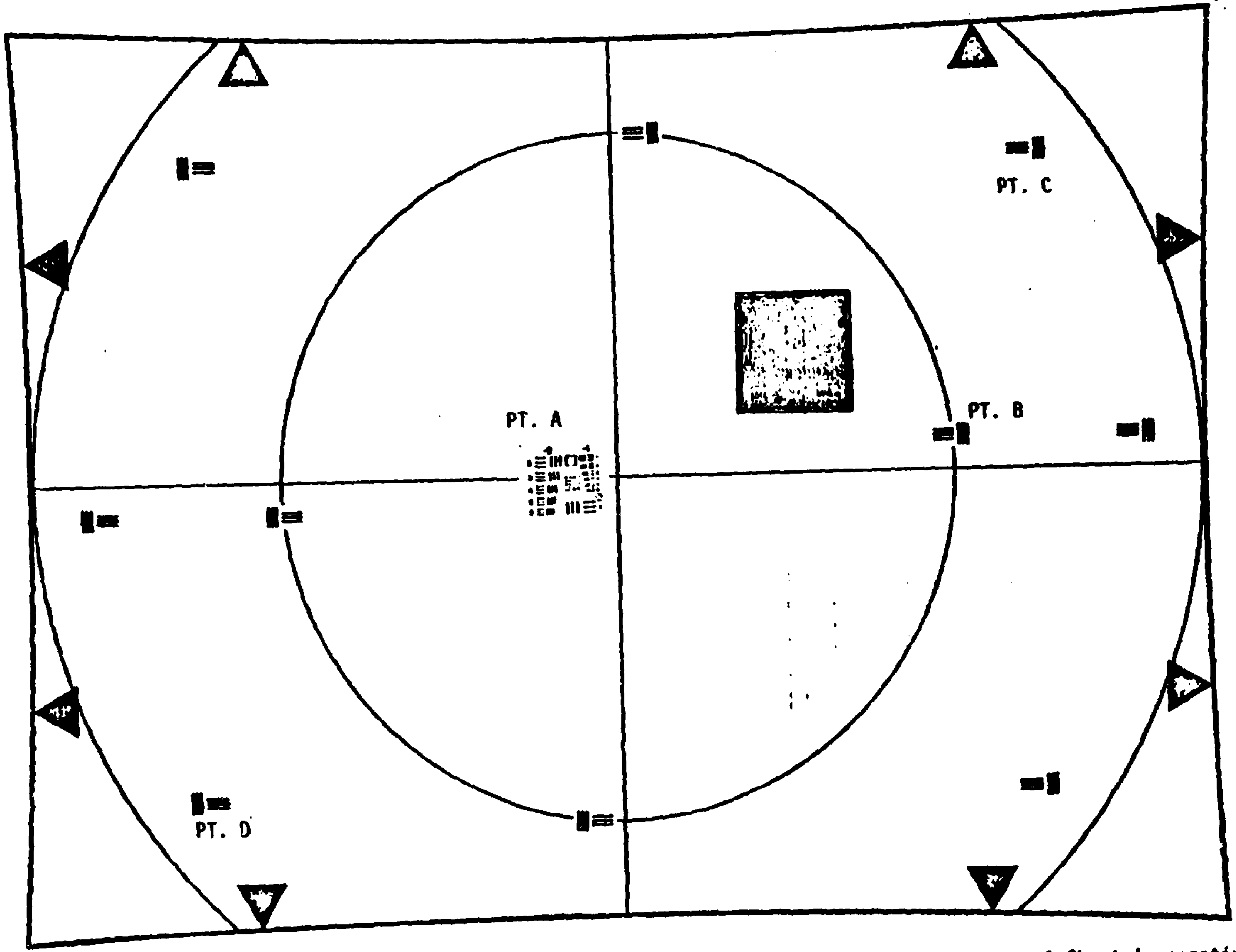


FIGURE 5.1-1 TEST CHART

NOTE: Actual Chart is negative of chart shown above.

TEST ITEM NO. 5.1	CONTROL ACTION OR PROCEDURE	EXPECTED RESULTS
1	LIGHT BOX SET-UP	
	a) Insert the Test Chart of Figure 5.1-1 into the Light Box	
	b) Position the Light Box so the probe views the Test Chart orthogonal to the line of sight with pitch set at approximately 10° down and heading set to produce a line of sight parallel to the floor.	The pitch down angle of 10° is required to prevent vignetting at the top of the picture due to shadowing caused by the end of the snout.
	c) Position the Light Box so that the front of the glass transparency is $9.96 \pm 1/32$ inch from the probe entrance pupil (center of pitch mirror).	The film chart is designed for a 10-inch viewing distance. However, the 1/16 inch cover glass makes the chart appear 1/3 x 1/16 inch closer, due to refraction. Also, a measurement made to the front of the cover glass must take into account thickness of the cover glass. Distance = 10 + (1/3 x 1/16) - 1/16 inch The 1/32 inch tolerance allows a 0.3% error.

TEST ITEM NO. 5.1 Cont'd		CONTROL ACTION OR PROCEDURE	EXPECTED RESULTS
	d)	Adjust left/right tilt of the Light Box and probe heading to remove any keystoning.	
	e)	Alternate procedures c) and d) until both conditions are met.	
	f)	Turn on motor drive for roll axis at the probe servo director. Adjust transparency translation slides until the center crosshair in the transparency is stationary with roll, indicating the center of the test chart is on the probe's optical axis.	
	g)	Recheck the distance to the probe entrance pupil	9.96 $\pm$ 1/32 inch
	h)	Adjust roll until the test chart vertical and horizontal in the color monitor as referenced to the color monitor's internal crosshatch pattern.	
	i)	Carefully adjust probe focus for the best compromise between horizontal and vertical resolution in the center of the picture with tilt set at zero (200° on dial).	

5.2 Power Output Level

5.2.1 Test Objective

To measure the laser power output from the three lasers - i.e., argon (blue and green), dye (yellow) and krypton (red).

5.2.2 Test Equipment Required

a) 5 channel probe servo director

b) Coherent Radiation model 210 optical wattmeter

5.2.3 Test Method

Read the output of the argon laser using the optical wattmeter built into its controller. Read the output of the dye and krypton lasers using an external optical wattmeter on the laser table at the output of each laser.

5.2.4 Initial Conditions

System warmed-up for 30 minutes.

5.2.5 Applicable Spec. Paragraphs

None

5.2.6 Detailed Procedure

The detailed procedure is given in the following table.

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TEST ITEM NO. 5.2	CONTROL ACTION OR PROCEDURE	EXPECTED RESULTS
1	PERIODIC TEST-POWER OUTPUT LEVEL	
	a) Set-up the Light Box and Test Chart as described in paragraph 5.1.	
	b) Record the current setting of the argon laser controller.	
	c) Record the output power from the argon laser using its controller's internal optical wattmeter	
	d) Record the output power from the yellow dye laser using the Model 210 optical wattmeter placed on the laser table at the output of the dye laser.	
	e) Record the current setting of the krypton laser controller	
	f) Record the output power from the krypton laser using the Model 210 optical wattmeter placed on the laser table at the output of the krypton laser.	

5.3 Video Levels

5.3.1 Test Objective

To measure and record the video levels in the red, green and blue channels.

5.3.2 Test Equipment Required

a) 5 channel probe servo director

b) PMT Light Box

c) Test Chart (Figure 5.1-1)

d) 50 MHz oscilloscope

5.3.3 Test Method

Using the oscilloscope and Camera Control Unit (CCU) measure the peak red, green and blue video levels.

5.3.4 Initial Condition

System warmed-up for 30 minutes.

5.3.5 Applicable Spec. Paragraphs

None

5.3.6 Detailed Procedure

The detailed procedure is given in the following table.

TEST ITEM NO. 5.3	CONTROL ACTION OR PROCEDURE	EXPECTED RESULTS
1	VIDEO AND PEDESTAL LEVEL	
	a) Set-up the Light Box and Test Chart as described in paragraph 5.1.	
	b) Record the PMT high voltage setting	
	c) Using the oscilloscope and CCU, measure the peak-white video level from the reference square (clear) portion of the test chart in the red, green and blue channels.	V_{red} = 0.7 volt V_{green} = 0.7 volt V_{blue} = 0.7 volt

5.4 Centering and Size

5.4.1 Test Objective

To verify that the centering and size of the image generation raster does not drift outside of the allowed field-of-view tolerance during a sustained operating period.

5.4.2 Test Equipment Required

a) 5 channel probe servo director

b) PMT Light Box

c) Test Chart (Figure 5.1-1)

5.4.3 Test Method

The PMT Light Box is set up orthogonal to the probe's line-of-sight. The Test Chart is moved around on the light box face (using the three axis slides) until it is centered on the roll axis of the probe and a set distance away from the probe entrance pupil. A check is then made as to whether the centering and sizing of the raster remains constant during a sustained operating period.

5.4.4 Initial Conditions

System warmed up for 30 minutes.

5.4.5 Applicable Spec. Paragraphs

3.4.5.1 (b), (d), and (e)

5.4.6 Detailed Procedure

The detailed procedure is given in the following table:

TEST ITEM NO. 5.4	CONTROL ACTION OR PROCEDURE	EXPECTED RESULTS
1	<u>CENTERING AND SIZE</u>	
	a) Set-up the Light Box and Test Chart as described in paragraph 5.1.	
	b) For test run after the initial set-up, check that the center cross-hair of the test chart still is stationary when the roll servo is activated. If not, adjust the probe heading and pitch to compensate for any drifts in the probe's look angle. Only do this if the roll center has definitely drifted and not just for minor correction since the inability to minimize the roll center exactly the same each time will introduce more error than a minor drift. Make sure to return to the smaller inner loop of the probe roll pattern when runout of the cross-hair is checked.	
	c) Observe the arrows or registration groups at the perimeter of the Test Chart on the color monitor and record any mis-match from the start of the day (the reference position of each arrow or registration group should be marked anew at the beginning of each day). Any mis-match should be recorded in terms of arc-minutes either by referencing to the size of the registration bars (each black bar is 5 arc-minutes and each white bar is 5 arc-minutes) or by measuring the mis-match on the face of the CRT with a flexible rule and then scaling to the 48^0 width of the color monitor face. The arrow tips and perimeter border of the test chart define a 36^0 vertical x 48^0 horizontal field-of-view.	
	d) Observe the center of cross-hair of the test chart on the color monitor and record any mis-match to its position marked at the beginning of each day in terms of arc-minutes. The cross-hair line width can be used as a reference (it is 5 arc-minutes in width at the center) or the mis-match can be scaled with a flexible rule and then scaled to the 48^0 width of the color monitor face.	

5.5 Color Registration

5.5.1 Test Objective

To measure the registration of the Laser Scanner Image Generator (LSIG).

5.5.2 Test Equipment Required

a) 5 channel probe servo director

b) PMT Light Box

c) Test Chart (Figure 5.1-1)

5.5.3 Test Method

The Test Chart contains groups of horizontal and vertical bars spread throughout the field-of-view of the LSIG. The spacing on these groups is 10 arc-minutes/line pair. Using the Camera Control Unit (CCU) any one color channel can be displayed on the B&W monitor. The three color channels are rapidly switched one at a time onto the B&W monitor and the jump of the three bar groups is estimated using the 10 arc-minutes spacing of the bars on a reference.

5.5.4 Initial Conditions

System warmed up for 30 minutes.

5.5.5 Applicable Spec. Paragraphs

4.1.1.2

3.4.5.6.1 (i) - as ammended by proposed spec. deviation

3.4.5.1 (m) - proposed spec. addition

5.5.6 Detailed Procedure

The detailed procedure is given in the following table:

TEST ITEM NO. 5.5	CONTROL ACTION OR PROCEDURE	EXPECTED RESULTS
1	REGISTRATION	
	a) Set-up the Light Box and Test Chart as described in paragraph 5.1	
	b) For tests run after the initial set-up, adjust the probe for best focus to compensate for any minor drifts in the probe focus and tilt servos that might have occurred.	
	c) Refer to Figure 5.1-1 and locate Point A on the B&W monitor, lay a strip of masking tape along the outside edge of the most outside vertical bar of the resolution group (-2,4) at Point A. The red channel alone is to be selected by the CCU. Group (-2,4) corresponds to 10 arc-minute/lp in the center.	
	d) On the B&W monitor, lay a strip of masking tape along the bottom edge of the bottom most horizontal bar of the resolution group (-2,4) at Point A. The red channel alone is to be selected by the CCU.	
	e) Adjust your head position so both strips of tape lay exactly along their respective target edges.	
	f) Without moving your head, quickly de-select the red channel and select the green channel with the buttons of the CCU. Record the estimated jump in arc-minutes in both horizontal position (horizontal registration using vertical bars) and vertical position (vertical registration using horizontal bars) of the bar group. Each white space is ~5 arc-minutes and each black space is ~5 arc-minutes.	$\leq \pm$ 8.4 arc-min at start * $\leq \pm$ 21.2 arc-min after 16 hr. *

TEST ITEM NO. 5.5 (cont'd)	CONTROL ACTION OR PROCEDURE	EXPECTED RESULTS
	g) Reselect the red channel and re-establish your head position.	
	h) Without moving your head, quickly de-select the red channel and select the blue channel with the buttons of the CCU. Record the estimated jump in arc-minutes in both horizontal and vertical position of the bar group.	$\leq \pm$ 8.4 arc-min at start * $\leq \pm$ 21.2 arc-min after 16 hr *
	i) Repeat the above procedures (c) thru (h) for points B, C, and D of Figure 5.1-1. The spacing of each group has been adjusted to yield 10 arc-minutes/line pair when viewed by the probe centered over the center cross-hair and 9.96 $\pm$ 1/32 inch from the front of the glass transparency.	For points A & B (0.8 picture ht) $\leq \pm$ 8.4 arc-min at start * $\leq \pm$ 21.2 arc-min after 16 hr * For points C and D (elsewhere) $\leq \pm$ 21.2 arc-min at start * $\leq \pm$ 42.3 arc-min after 16 hr * * Based on a Root Sum Square (RSS) calculation of the image generator component of the system registration given the system and display specification - i.e., $Error_{IG} = \sqrt{Error^2_{System} - Error^2_{Display}}$

TEST ITEM NO. 5.6		CONTROL ACTION OR PROCEDURE	EXPECTED RESULTS
1		RESOLUTION	
	a)	Set-up the Light Box and Test Chart as described in paragraph 5.1.	
	b)	For tests run after the initial set-up, check that tilt is zero (200^{0} on dial) and then carefully adjust probe focus for the best compromise between horizontal and vertical resolution in the center of the picture. Record the horizontal (vertical bars) and vertical (horizontal bars) resolution on the color monitor in the center of the picture.	Group (-1,1) should be resolved both vertically and horizontally. This corresponds to 7 arc-minutes/line pair at a probe pupil to target distance of 10 inches (9.96$\pm$ 1/32 inch to front of glass) Note that the Air Force target on the Test Chart has been reduced to 1/3.867 of normal scale.

5.6 System Resolution

5.6.1 Test Objective

To verify that system resolution is in accordance with the specification

5.6.2 Test Equipment Required

a) 5 channel probe servo director

b) PMT Light Box

c) Test Chart (Figure 5.1-1)

5.6.3 Test Method

The probe is focused for best resolution and the resolved group is read from the Air Force resolution target at the center of the Test Chart. No Scheimpflug tilt is used in the probe and the chart is located at a distance far enough away to be considered infinity.

5.6.4 Initial Conditions

System warmed-up for 30 minutes

5.6.5 Applicable Spec. Paragraphs

4.1.1.2

3.4.5.1

5.6.6 Detailed Procedure

The detailed procedure is given in the following table:

TEST ITEM NO. 5.6	CONTROL ACTION OR PROCEDURE	EXPECTED RESULTS
1	RESOLUTION	
	a) Set-up the Light Box and Test Chart as described in paragraph 5.1.	
	b) For tests run after the initial set-up, check that tilt is zero (200^{0} on dial) and then carefully adjust probe focus for the best compromise between horizontal and vertical resolution in the center of the picture. Record the horizontal (vertical bars) and vertical (horizontal bars) resolution on the color monitor in the center of the picture.	Group (-1,1) should be resolved both vertically and horizontally. This corresponds to 7 arc-minutes/line pair at a probe pupil to target distance of 10 inches (9.96$\pm$ 1/32 inch to front of glass) Note that the Air Force target on the Test Chart has been reduced to 1/3.867 of normal scale.

6.0 DAILY TEST RESULTS TABLES

Tables 6.-1 and 6.-2 are to be used to record the daily test results on odd and even days respectively.

LIBRASCOPE ______________

HOUR NO.	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PWR OUTPUT: ARGON WATTS	ARGON AMPS	KRYPTON WATTS	KRYPTON AMPS	DYE WATTS	TEST 5.3 VIDEO LEVEL: V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HI VOLTAGE (VOLTS)
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16 Before Adjust													
16 After Adjust													

TABLE 6.-1 ODD DAY TABLE

DATE ________ WITNESSED BY: GOV'T ________

LINK ________

LIBRASCOPE ________

HOUR NO. Cont'd	TEST 5.4 CENTER & SIZE					TEST 5.5 REGISTRATION							
						PT. A		PT. B		PT. C		PT. D	
	CENTER ↑+ →+ (ARC-MIN)	LEFT +← (ARC-MIN)	RIGHT →+ (ARC-MIN)	TOP ↑+ (ARC-MIN)	BOTTOM ↓+ (ARC-MIN)	HORIZ* REG (ARC-MIN)	VERT* REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16 Before Adj													
After Adj													

* NOTE: HORIZ REG → VERT BARS VERT REG ⇒ HORIZ BARS

TABLE 6.-1 ODD DAY TABLE (CONT'D)

SHEET 2 of 3

LINK ______

LIBRASCOPE ______

HOUR NO. (CON'T)	TEST 5.6 RESOLUTION* FOCUS DIAL (DEG.)	HORIZ RES. (GROUP)	VERT RES. (GROUP)	ADJUSTMENTS MADE AT HOUR 16	COMMENTS
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16 Before Adj.					
16 After Adj.					

*NOTE - Horiz Res → Vert Bars,
Vert Res → Horiz Bars

TABLE 6.-1 ODD DAY TABLE (CON'T)

LINK ______________

LIBRASCOPE ______________

HOUR NO.	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PWR OUTPUT					TEST 5.3 VIDEO LEVEL			
					ARGON		KRYPTON		DYE	V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HI VOLTAGE (VOLTS)
					WATTS	AMPS	WATTS	AMPS	WATTS				
1													
2													
3													
4													
5													
6													
7													
8													
9 Before Adj													
9 After Adj													
10													
11													
12													
13													
14													
15													
16 Before Adjust													
16 After Adjust													

TABLE 6.-2 EVEN DAY TABLE

Sheet 1 of 3

LINK ____________________

LIBRASCOPE ____________________

HOUR NO. Cont'd	TEST 5.4 CENTER & SIZE					TEST 5.5 REGISTRATION							
						PT. A		PT. B		PT. C		PT. D	
	CENTER ↑+ →+ (ARC-MIN)	LEFT +← (ARC-MIN)	RIGHT →+ (ARC-MIN)	TOP ↑+ (ARC-MIN)	BOTTOM ↓+ (ARC-MIN)	HORIZ* REG (ARC-MIN)	VERT* REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)
1													
2													
3													
4													
5													
6													
7													
8													
Before [illegible]													
[illegible] Adj													
10													
11													
12													
13													
14													
15													
16 Before Adj													
After Adj													

* NOTE: HORIZ REG → VERT BARS VERT REG → HORIZ BARS

TABLE 6.-2 EVEN DAY TABLE

SHEET 2 of 3

LINK ______

LIBRASCOPE ______

HOUR NO. (CON'T)	TEST 5.6 RESOLUTION* FOCUS DIAL (DEG.)	HORIZ RES. (GROUP)	VERT RES. (GROUP)	ADJUSTMENTS MADE AT HOUR 9	ADJUSTMENTS MADE AT HOUR 16	COMMENTS
1						
2						
3						
4						
5						
6						
7						
8						
9 Before Adj						
9 After Adj						
10						
11						
12						
13						
14						
15						
16 Before Adj.						
16 After Adj.						

*NOTE - Horiz Res ⇒ Vert Bars
Vert Res ⇒ Horiz Bards

TABLE 6.-2 EVEN DAY TABLE (CONT'D)

Appendix B

ASSESSMENT LOG SHEETS

DATE 12/1/80 WITNESSED BY: GOV'T ______
LINK Mark Elmonde
LIBRASCOPE John Border

HOUR NO.	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PWR OUTPUT ARGON WATTS	ARGON AMPS	KRYPTON WATTS	KRYPTON AMPS	DYE WATTS	TEST 5.3 VIDEO LEVEL V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HI VOLTAGE (VOLTS)
1	7:00	120	70	64	4.0	31	275 mw	27.5	.180	.70	.70	.73	1200 V
2	8:00	120	70	64									
3	9:00	120	70	64	4.0	31	275 mw	27.5	.200	.70	.70	.70	1200 V
4	10:00	120	72	57									
5	11:00	120	71	61	4.0	31	275 mw	27.5	.200	.70	.60	.65	[illegible]
6	12:00	120	72	65									
7	1:00	120	73	61	4.0	31	275 mw	27.5	.200	.70	.65	.73	[illegible]
8	2:00	120	74	58									
9	3:00	120	73	53	4.0	30	275 mw	27.5	.200	.60	.50	.50	1200
10	4:00	SEE COMMENTS											
11	5:00												
12	6:00	120	72	50									
13	7:00	120	73	50	4.0	30.5	275 mw	29.0	210 mw	.70	.70	.75	1200
14	8:00	120	78	46									
15	9:00	120	79	35	4.0	30.5	275 mw	29.0	210 mw	.45	.40	.60	1200
Before Adjust	10:00	120	78	44	3.9	30.7	250 mw	28.5	210 mw	.40	.40	.50	1200
After Adjust	10:20	120	78	44	3.9	31.0	255 mw	29.0	210 mw	.60	.50	.50	1200

TABLE 6.-1 ODD DAY TABLE

SHEET 1 of 3

DATE 12/1/80 WITNESSED BY: GOV'T ______
LINK Mark Elmendorf
LIBRASCOPE J. Ron Borden

HOUR NO. Cont'd	TEST 5.4 CENTER & SIZE: CENTER ↑+ →+ (ARC-MIN)	LEFT +← (ARC-MIN)	RIGHT →+ (ARC-MIN)	TOP ↑+ (ARC-MIN)	BOTTOM ↓+ (ARC-MIN)	TEST 5.5 REGISTRATION: PT. A HORIZ* REG (ARC-MIN)	PT. A VERT* REG (ARC-MIN)	PT. B HORIZ REG (ARC-MIN)	PT. B VERT REG (ARC-MIN)	PT. C HORIZ REG (ARC-MIN)	PT. C VERT REG (ARC-MIN)	PT. D HORIZ REG (ARC-MIN)	PT. D VERT REG (ARC-MIN)
1	—	START	—	—	—	0 0	0 0	+1 0	0 -1	0 0	0 0	+1 -1	-1 0
2													
3													
4													
5	0	0	0	0	0	0 0	0 0	+1 0	0 -1	-2 0	-1 0	0 -1	-2 0
6													
7													
8													
9													
10													
11													
12													
13	—	3RT 2UP	1RT 1UP	2UP 2UP	NO MARKS	0 0	3UP 2UP	0 0	2UP 2UP	0 0	0 0	0 0	2UP 2UP
14													
15													
Before Adj	~~[illegible]~~	5LT 5UP	6LT 5UP	3UP 5UP	NO MARKS	2IN 3IN	3UP 2UP	0 2IN	2UP 2UP	0 0	2UP 2UP	2IN 3IN	3UP 2UP
After Adj	POWER KNOCKED OFF BY GUARD UNABLE TO MEASURE					0 +1	0 0	0 -1	0 0	0 0	0 0	0 1	0 0

*NOTE: HORIZ REG → VERT BARS VERT REG ⇒ HORIZ BARS

TABLE 6.-1 ODD DAY TABLE (CONT'D)

DATE: 12/1/80 WITNESSED BY: GOVT
LINK Mark Edwards
LIBRASCOPE John Borden

HOUR NO. (CON'T.)	TEST 5.6 RESOLUTION* FOCUS DIAL (DEG.)	HORIZ RES. (GROUP)	VERT RES. (GROUP)	ADJUSTMENTS MADE AT HOUR 16	COMMENTS
1	201° 18'	– 1.3	– 1.2		NO. 1 ADDED TO GREEN
2	201° 3'	– 1.4	– 1.2		
3	201° 27'	– 1.3	– 1.2		
4	201° 12'	– 1.3	– 1.2		RESTART SPINNER (10:00)
5	201° 18'	– 1.3	– 1.2		RESTART SPINNER (11:10)
6	201° 15'	– 1.3	– 1.2		
7	201° 45'	– 1.3	– 1.2		RESTART SPINNER (1:45)
8	201° 33'	– 1.3	– 1.1		RESTART SPINNER (2:03), AND (2:40)
9					INTENSITY FLUTTER ON WHITE BACKGROUND DUE TO TOP PERISCOPE MIRROR DRIFT
10					OFF AT 3:20 PM SPINNER GOING OUT OF SYNC. PROBLEM TRACED TO BAD CONNECTOR. ATTEMPTED FIX - BEARING PINS-
11					DAMAGED PIN 20. RESOLDERED WIRES. SOMEWHAT BETTER TO CARD MOVEMENT. RESTART 5:15 PM
12	200° 54'	– 1.3	– 1.2		
13	200° 50'	– 1.3	– 1.2		6:18 SPINNER SHUT DOWN: BAD CONNECTOR ON CARD [illegible] RESTART 6:35
14	200° 45'	– 1.1	– 1.1		7:30 SPINNER SHUT DOWN RESTART 7:31 / AT 8:00 NOTICED AIR CONDITIONER SHUT DOWN
15	200° 35'	– ~~2.5~~ 2.6 ME	– ~~2.5~~ 2.6 ME		
efore Adj.	199° 24'	VERY BAD	VERY BAD	ADJ. BEAM POINTING MIRROR ADJ. BLUE, GG, YELLOW REG.	UNABLE TO OBSERVE ACCURATE RESOLUTION DUE TO LOUSY CONVERGENCE
fter Adj.	200° 15'	– 1.3	– 1.2		END TEST 10:30 PM

OTE - Horiz Res ⇒ Vert Bars,
Vert Res ⇒ Horiz Bars

TABLE 6.-1 ODD DAY TABLE (CON'T)

DATE 12-2-80 WITNESSED BY: GOV'T ______
LINK Mark Almonder
LIBRASCOPE John Borda

HOUR NO.	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PWR OUTPUT ARGON WATTS	ARGON AMPS	KRYPTON WATTS	KRYPTON AMPS	DYE WATTS	TEST 5.3 VIDEO LEVEL V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HI VOLTAGE (VOLTS)
1	7:10 AM	120	68°/64°	62%	4	31	.275	29	.200	.7	.8	.8	1200
2	8:10	120	68°/64°	58%									
3	9.14	120	68°/64°	54%	4	29	.275	29.5	.200	.6	.85	.7	1200
4	10.12	120	68°/64°	54%									
5	11:12	120	68°/64°	54%	4	29	.275	29.5	.200	.6	.7	.7	1200
6	12:12	120	68°/64	54%									
7	1:11	120	70°/64°	55%	4	31	.275	28.0	.200	.6	.7	.7	1200
8	2:11	120	70°/64°	55%									
fore	3:14	120	70°/64°	59%	4	31	.260	28.5	.215	.6	.75	.7	1200
ter	6:20	122	70/60	58%	4.0	31.2	.255	28.5	.210	.7	.7	.7	1200
10	See Comments												
11													
12	6:20	122	70/60	55%									
13	7:10	122	70/62	64%	4.0	31.4	.260	28.5	.210	.7	.8	.8	1200
14	8:10	123	70/62	64%									
15	9:10	122	70/60	55%	3.9	31.2	.260	28.5	.205	.55	.50	.50	1200
fore just	10:00	122	70/62	64%	4.0	31.2	.260	28.7	.200	.55	.45	.45	1200
ter just	10:13	122	70/62	64%	4.0	31.2	.260	28.5	.205	.70	.70	.65	1200

TABLE 6.-2 EVEN DAY TABLE

DATE 12-2-80 WITNESSED BY: GOV'T ______
LINK Mark Chamber
LIBRASCOPE John Borden

OUR D. ont'd	TEST 5.4 CENTER & SIZE: CENTER ↑+ →+ (ARC-MIN) H, V	LEFT +← (ARC-MIN)	RIGHT →+ (ARC-MIN)	TOP ↑+ (ARC-MIN)	BOTTOM ↓+ (ARC-MIN)	TEST 5.5 REGISTRATION: PT. A HORIZ* REG (ARC-MIN) RG	RB	PT. A VERT* REG (ARC-MIN) RG	RB	PT. B HORIZ REG (ARC-MIN) RG	RB	PT. B VERT REG (ARC-MIN) RG	RB	PT. C HORIZ REG (ARC-MIN) RG	RB	PT. C VERT REG (ARC-MIN) RG	RB	PT. D HORIZ REG (ARC-MIN) RG	RB	PT. D VERT REG (ARC-MIN) RG	RB
1	←	S	T	A	RT →	0	0	0	-1	-1	-1	0	0	0	-1	0	-1	+1	+1	0	0
2																					
3																					
4																					
5	+1, 0	+1	-1	+1	-1	0	0	0	-2	-1	-1	0	1	0	-2	0	-2	0	+1	0	+1
6																					
7																					
8																					
Before Adj	35, 0	-1	+20	0	0	0	-4	-1	0	0	-5	0	0	-1	-1	0	0	0	-2	0	0
After Adj	←	S T	A	R T	→	0	-1	0	0	-2	-2	0	0	-3	-2	0	0	0	-3	0	0
10																					
11																					
12																					
13	0, 0	0	0	0	0	-1	-1	0	0	-2	-3	0	0	-4	-2	0	0	0	0	+2	+1
14																					
15																					
fore Adj	+10, 0	+2	+2	-2	0	0	+3	0	+3	0	0	0	+2	0	0	0	+2	0	+3	0	+2
ter Adj	←	S T	A R	T	→	0	0	0	0	-3	-3	0	0	-4	-2	-3	0	0	0	0	0

NOTE: HORIZ REG → VERT BARS VERT REG → HORIZ BARS

TABLE 6.-2 EVLN DAY TABLE

DATE: 12-2-80 WITNESSED BY: GOVT
LINK Mark Elmonten
LIBRASCOPE John Boredas

OUR NO. (CON'T)	TEST 5.6 RESOLUTION* FOCUS DIAL (DEG.)	HORIZ RES. (GROUP)	VERT RES. (GROUP)	ADJUSTMENTS MADE AT HOUR 9	ADJUSTMENTS MADE AT HOUR 16	COMMENTS
1	201° 12'	-1.4	-1.2			
2	200° 45'	-1.3	-1.2			
3	200° 55'	-1.3	-1.2			
4	201° 15'	-1.3	-1.2			
5	201° 18'	-1.3	-1.2			
6	201° 12'	-1.3	-1.2			
7	201° 0'	-1.3	-1.2			
8	201° 0'	-1.3	-1.2			
ore	201° [illegible]3'	-1.4	-1.1			
ter	201° 15'	-1.3	-1.1	ADJ. B,G,Y MIRRORS, TOP PERISCOPE MIRROR, R+B CLAMP GAIN		6:43 SPINNER OFF REACTIVATE
10	{SEE COMMENTS}					SPINNER PC BOARD 220 DETERMINED INTERMITTENT-
11						CORRESPONDING CONNECTOR REPLACED.
12	201° 15'	-1.3	-1.1			
13	201° 10'	-1.3	-1.1			
14	200° 12'	-1.3	-1.1			LIGHT LEVELS DROPPED R:.55 G:.5 B:.5
15	200° 6'	-1.3	-1.1			
ore Adj.	200° 22'	-1.4	-1.1		VERT. ADJ. TOP PERISCOPE MIRROR ADJ. B,G,Y MIRRORS	
ter Adj.	200° 48'	-1.4	-1.1		ADJ HEADING, ROLL, PITCH	TOP PERISCOPE MIRROR ADJ. BROUGHT ALL VIDEO LEVELS UP.

TE - Horiz Res ⇒ Vert Bars
Vert Res ⇒ Horiz Bards

TABLE 6.-2 EVEN DAY TABLE (CONT'D)

END TEST
10:26

SHEET 3 of 3

DATE 12/3/80 WITNESSED BY: GOV'T [illegible] (Mitre Corp)
LINK M. [illegible]
LIBRASCOPE M. [illegible]

HOUR NO.	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PWR OUTPUT: ARGON WATTS	ARGON AMPS	KRYPTON WATTS	KRYPTON AMPS	DYE WATTS	TEST 5.3 VIDEO LEVEL: V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HI VOLTAGE (VOLTS)
1	9:30	120	69/62	68%	4.0	(31.5) 31.5	.265	29	.060/.200	.70	.70	.70	1200
2	10:30	120	70/62	64%									
3	11:30	120	69/63	59%	4.1	31.5	.265	29	.205	.70	.75	.70	1200
4	12:30	120	70/63	59%									
5	1:30	120	70/64	55%	4.1	33.5	.270	29	.200	.70	.70	.6	1200
6	2:30	120	70/63	55%									
7	3:30	120	72/64	61%	4.1	33.2	.260	29	.200	.70	.70	.6	1200
8	4:30	120	70/62	55%	4.1	33.0	.250	29	.200	.7	.7	.6	1200
9	5:30	120	70/62	64%	4.1	33.8	.260	29.5	.210	.7	.7	.6	1200
10	6:30	120	70/60	55%									
11	7:30	120	70/63	55%	4.1	34	.250	29.5	.210	.69	.7	.65	1200
12	8:30	120	70/63	59%									
13	9:30	120	70/64	64%	4.1	34.2	.255	29.5	.205	.66	.7	.60	1200
14	10:30	120	71/64	64%									
15	11:30	120	71/64	64%	4.1	34.7	.250	29	.205	.68	.7	.62	1200
Before Adjust	12:30	120	70/63	55%	4.1	34.5	.250	29	.205	.70	.7	.63	1200
After Adjust													

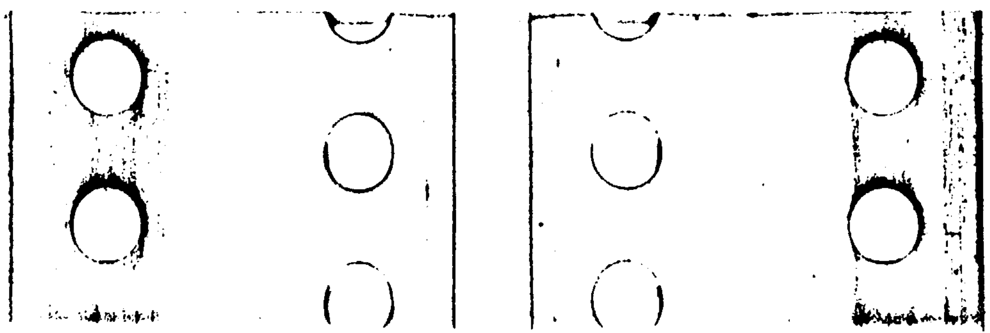
DATE 12/3/80 WITNESSED BY: GOV'T Robert Ferguson (Mitr Only)
LINK M. Elmore
LIBRASCOPE Ni Wunsse

HOUR NO. Cont'd	TEST 5.4 CENTER & SIZE: CENTER ↑+ →+ (ARC-MIN) H, V	LEFT +← (ARC-MIN)	RIGHT →+ (ARC-MIN)	TOP ↑+ (ARC-MIN)	BOTTOM ↓+ (ARC-MIN)	TEST 5.5 REGISTRATION: PT. A HORIZ* REG (ARC-MIN) RG	PT. A HORIZ* REG RB	PT. A VERT* REG (ARC-MIN) RG	PT. A VERT* REG RB	PT. B HORIZ REG (ARC-MIN) RG	PT. B HORIZ REG RB	PT. B VERT REG (ARC-MIN) RG	PT. B VERT REG RB	PT. C HORIZ REG (ARC-MIN) RG	PT. C HORIZ REG RB	PT. C VERT REG (ARC-MIN) RG	PT. C VERT REG RB	PT. D HORIZ REG (ARC-MIN) RG	PT. D HORIZ REG RB	PT. D VERT REG (ARC-MIN) RG	PT. D VERT REG RB
1	←	START			→	0	0	0	0	-2	0	0	0	-2	-2	0	0	0	0	0	0
2																					
3																					
4																					
5	+5, 0	-2	-2	0	0	0	-1	0	0	-2	-1	0	+1	-2	0	0	+1	0	0	+1	+1
6																					
7																					
8																					
9	←	START			→	-1	-2	+1	0	-1	-1	0	0	-1	0	0	0	0	+2	0	0
10																					
11																					
12																					
13	+10 +7	-5	+5	0	+10	0	+2	0	0	0	0	0	0	0	0	0	0	0	+2	-2	0
14																					
15																					
16 Before Adj	0 +7	0	0	+2	+10	0	+2	+2	+2	-2	-2	0	0	0	0	0	0	0	0	-2	+2
After Adj																					

* NOTE: HORIZ REG → VERT BARS VERT REG → HORIZ BARS

TABLE 6.-1 ODD DAY TABLE (CONT'D)

SHEET 2 of 3



...E: 1/80 ....IESSL ... GO [illegible]
LINK [illegible]
LIBRASCOPE [illegible]

HOUR NO. (CON'T)	TEST 5.6 RESOLUTION* FOCUS DIAL (DEG.)	HORIZ RES. (GROUP)	VERT RES. (GROUP)	ADJUSTMENTS MADE AT HOUR 16	COMMENTS
1	200° 57'	-1,4	-1,1		ADJUSTED PUMPING BEAM INTO DYE LASER ([illegible]) RECESS (.200) axis late start because a damaged (burned) rear cavity dye mirror was discovered. Mirror rotated to get beam off of burned spot. Subsequent table realignment.
2	200° 52'	-1,4	-1,1		
3	200° 56'	-1,4	-1,1		
4	200° 56'	-1,4	-1,1		
5	200° 56'	-1,4	-1,1		
6	201° 17'	-1,4	-1,1		
7	200° 57'	-1,4	-1,2		
8	201° 0'	-1,4	-1,2		None, [illegible]
9	200° 26'	-1,2	-1,1		None
10	200° 39'	-1.3	-1.2		None
11	200° 57'	-1.3	-1.2		None
12	200° 54'	-1.3	-1.2		None
13	200° 48'	-1.3	-1.2		None
14	200° 36'	-1.3	-1.2		None
15	200° 48'	-1.3	-1.2		None
16 Before Adj.	200° 36'	-1.3	-1.2		
After Adj.					Readjustments not needed - not made

*NOTE - Horiz Res → Vert Bars
Vert Res → Horiz Bars

TABLE 6.-1 ODD DAY TABLE (CON'T)

SHEET 3 of 3

Heading - 3° 47'
Pitch - 207° 41'
Roll - 8° 36'
Focus - 201° 27'

DATE 12/4/80 WITNESSED BY: GOV'T Robert Ferguson (Monitor Eng)
LINK
LIBRASCOPE M. Marc

	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PWR OUTPUT ARGON WATTS	ARGON AMPS	KRYPTON WATTS	KRYPTON AMPS	DYE WATTS	TEST 5.3 VIDEO LEVEL V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HI VOLTAGE (VOLTS)
	9:30	120v	72°/64°	69%	3.2	32.5	.260	29	.030	.7	.2	.4	1200
	10:30	121v	70°/62°	64%									
	11:30	SEE	COMMENTS										
	12:30	120v	71°/65°	68%									
	1:30	120V	70°/64°	64%	3.7	35	.255	29	.180	.6	.6	.7	1200
	2:30	120V	70°/64°	64%									
	3:30	121V	72°/64	~~69%~~ 69%	3.9	34	.265	29	.212	.6	.6	.6	1200
	4:30	123	69°/60	63%						.6	.6	.6	1200
ore	5:30	120V	69°/60	63%	4.0	34.5	.255	29	.205	.6	.7	.6	1200
er	6:05	121V	72°/63	65%	4.0	35.0	.250	29	.205	.6	.6	.5	1200
	6:30	120V	70/63	64%									
	7:30	120V	71/64	64%	4.0	36	.240	28.5	.200	.6	.6	.5	1200
	8:30	121	70/64	68%									
	9:30	120	70/64	64%	3.9	36.5	.240	28.5	.180	.6	.6	.5	1200
	10:30	120	70/64	64%									
	11:30	120	71/64	64%	3.85	35.2	.230	28.5	.160	.6	.55	.45	1200
fore Adjust	12:02	See	Comments										
ter Adjust													

TABLE 6.-2 EVEN DAY TABLE

DATE 12/4/80 WITNESSED BY: GOV'T [illegible] (Monitor Only)
LINK
LIBRASCOPE M. [illegible]

	TEST 5.4 CENTER & SIZE					TEST 5.5 REGISTRATION							
						PT. A		PT. B		PT. C		PT. D	
d	CENTER ↑+ →+ (ARC-MIN) H V	LEFT +← (ARC-MIN)	RIGHT →+ (ARC-MIN)	TOP ↑+ (ARC-MIN)	BOTTOM ↓+ (ARC-MIN)	HORIZ* REG (ARC-MIN) 2C 2B	VERT* REG (ARC-MIN) 2C 2B	HORIZ REG (ARC-MIN) 2C 2B	VERT REG (ARC-MIN) 2C 2B	HORIZ REG (ARC-MIN) 2C 2B	VERT REG (ARC-MIN) 2C 2B	HORIZ REG (ARC-MIN) 2C 2B	VERT REG (ARC-MIN) 2C 2B
	←	START			→	0, -1	0, 0	-1, -2	0, 0	0, 0	0, 0	0, -1	0, 0
	+20, +20	-15	+15	+5	+5	0, -1	0, 0	-1, -2	0, 0	0, 0	0, 0	0, 0	0, 0
r													
fore	old	marks	not	cal. brated	because of	controller 0, 0	0 [illegible] +2	0, 0	0 [illegible] 0	0 [illegible] +2	0, 0	-2, 0	+2, +1
ter	-5, -3	-10	-10	0	-5	0, 0	0, 0	0, 0	0, 0	0, 0	0, 0	0, 0	0, 0
	0, -20	0	0	-5	0	0, 0	0, 0	0, 0	0, 0	0, 0	0, 0	0, 0	0, 0
ore Adj													
er Adj													

TE: HORIZ REG → VERT BARS VERT REG → HORIZ BARS

TABLE 6-2 EVEN DAY TABLE

DATE: 12/1/80 WITNESSED BY: GOVT Robt Fagan (Mitre Corp.)
LINK
LIBRASCOPE M. Marsi

NO. T)	TEST 5.6 RESOLUTION* FOCUS DIAL (DEG.)	HORIZ RES. (GROUP)	VERT RES. (GROUP)	ADJUSTMENTS MADE AT HOUR 9	ADJUSTMENTS MADE AT HOUR 16	COMMENTS
	201° 39'	-1,4	-1,1			[illegible] TRIED TO CLEAN ARGON
	201° 30'	-1,4	-1,1	Adjusted Harding lens		LASER OPTICS, WILL TRY NEW MIRROR TODAY.
	~~[illegible]~~	~~[illegible]~~	~~[illegible]~~	roll pitch - new set-up		AT 11:00 PUT IN NEW REAR CAVITY MIRROR TOOK THE 30 MIN [illegible] LASE
	201° 10'	-1,3	-1,1	for start - Resultant		
5	201° 15'	-1,3	-1,1	colors on table -		3.7w Argon becoming light [illegible] not aligned. Re-aligned [illegible] 4.0 hr.
6	201° 28'	-1,2	-1,1	tried touching up.		Low VOLTAGE (PHASE IN S.P. LASER supply unstable. (see notebook)
7	201° 27'	-1,3	-1,1	Argon laser. There appears		
8	201° 23'	-1.1	-1.1	to be a misalignment		Spinner cut out 3 times [illegible]
	201° 20'	-1.2	-1.2	of laser to table.		Power cord to [illegible] interrupted - [illegible] dial
	200° 58'	-1.3	-1.2	This reduced signal.		Spectra Physics off - center 6:23 Spinner off
10	200° 49'	-1.3	-1.2	level and required		
11	200° 57'	-1.3	-1.2	increase in laser current.		none
12	200° 57'	-1.3	-1.2	- backed off & re-set		none
13	200° 39'	-1.3	-1.3	to original -		8:42 Spinner off
14	200° 52'	-1.3	-1.3	* Power output glitch		none
15	200° 53'	-1.3	-1.3	on Argon laser observed		none
re Adj.				earlier is gone		12:02 spectra physics shutdown completely.
r Adj.						

E - Horiz Res → Vert Bars
Vert Res → Horiz Bards

TABLE 6.-2 EVEN DAY TABLE (CONT'D)

DATE 12-5-80 WITNESSED BY: GOV'T ______
LINK ______
LIBRASCOPE M. Mance

[illegible]E [illegible]ART [illegible]END [illegible]CH [illegible]LY [illegible]ST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PWR OUTPUT ARGON WATTS	ARGON AMPS	KRYPTON WATTS	KRYPTON AMPS	DYE WATTS	TEST 5.3 VIDEO LEVEL V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HI VOLTAGE (VOLTS)	
[illegible]30	120	68°/64	71%	See comments		270	29.5	See Comments	.7	See Comments		1200	PQ
[illegible]30	120	69°/64	67%										
[illegible]30	120	70°/64°	68%			250	29.5		.7			1200	
[illegible]30	120	70°/64°	68%										
[illegible]30	120	69°/64°	67%			250	29.5		.375			1200	PQ
[illegible]30	120	69°/64°	67°										
[illegible]:30	122	68°/62°	71%	See Comment					0.6			1200	DSC

TABLE 6.-1 ODD DAY TABLE

DATE 12-5-80 WITNESSED BY: GOV'T ____________
LINK ____________
LIBRASCOPE ____________

	TEST 5.4 CENTER & SIZE					TEST 5.5 REGISTRATION							
						PT. A		PT. B		PT. C		PT. D	
	CENTER ↑+ →+ (ARC-MIN)	LEFT +← (ARC-MIN)	RIGHT →+ (ARC-MIN)	TOP ↑+ (ARC-MIN)	BOTTOM ↓+ (ARC-MIN)	HORIZ* REG (ARC-MIN)	VERT* REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)
	←	S T	A R T	→	→	← SEE		COMMENTS		→	→	→	→
	-4, +2	+2	-2	-2	+2								
Adj													
Adj													

HORIZ REG → VERT BARS VERT REG → HORIZ BARS

TABLE 6.-1 ODD DAY TABLE (CONT'D)

DATE: 12/5/80 WITNESSED BY: GOVT ______
LINK ______
LIBRASCOPE M. Maure

NO. ('T)	TEST 5.6 RESOLUTION* FOCUS DIAL (DEG.)	HORIZ RES. (GROUP)	VERT RES. (GROUP)	ADJUSTMENTS MADE AT HOUR 16	COMMENTS
1	201° 10'	-1.4	1.2		RED ONLY ; The Spectra Physics argon laser power supply is not providing proper voltage regulation. The result is that a protect circuit shuts the laser down completely. A repairman will be here 12/7/80.
2	201° 15'	1.4	1.2		
3	201° 12'	1.4	1.2		
4	201° 30'	1.4	1.2		
5	201° 27'	1.4	1.2		
6	201° 35'	1.4	1.2		
7	~	~~1.3~~	~~1.2~~	~~None~~	Red. Only Operation Spinner operation OK for entire
8	201° 18'	1.3	1.2	None	period. Equipment shut down — DAB
9					
10					
11					
12					
13					
14					
15					
...re Adj.					
...r Adj.					

...E - Horiz Res → Vert Bars
Vert Res → Horiz Bars

TABLE 6.-1 ODD DAY TABLE (CON'T)

DATE 12/1/80

WITNESSED BY: GOV'T [illegible signature]
LINK [illegible signature]
LIBRASCOPE M. [illegible] / J. [illegible]

HOUR NO.		TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PWR OUTPUT					TEST 5.3 VIDEO LEVEL			
						ARGON		KRYPTON		DYE	V SIGNAL RED	V SIGNAL GREEN	V SIGNAL BLUE	HI VOLTAGE
						WATTS	AMPS	WATTS	AMPS	WATTS	(VOLTS)	(VOLTS)	(VOLTS)	(VOLTS)
1		7:00	120	67°/63	58%	4	27.5	.250	29	.220	.7	.7	.7	1200
2		8:00	120	67°/63°	50%									
3		9:00/9:15	120	68/64°	58%	4	27.5	.220	29.5	.200	.7	.7	.7	1000
4		10:00/10:15	120	70°/63°	55%									
5		11:02/11:15	120	70/62°	48%	4.0	27.2	PS. .250	29.5	.230	.55	.5	.55	1200
6		12:00/12:05	120	70/63°	50%									
7		1:29/1:35	120	69/65°	50%	4	29	.220	29.5	.225	.5	.5	.5	1200
8		2:00	120	69°/63°	50%									
9	Before Adj	3:12/3:20	120	70°/62°	48%	3.9	28.5	.230	29.5	.235	.5	.5	.6	1200
	After Adj	3:40/3:48	121	70°/62°	55%	4.0	29.0	.240	29.5	.240	.7	.7	.7	1200
10		4:00	120	70°/62°	55%									
11		5:00	121	70°/63	48%	4.0	29.2	.230 (.220)	29.5	.230	.7	.7	.7	1200
12		6:00	120	70/64°	48%									
13		7:00	120	70°/64°	44%	4.0	29.3	.210	29.8	.230	.68	.7	.7	1200
14		8:00	121	70/64°	48%									
15		9:00	120	70/60°	44%	4.0	29.5	.220	29.5	.240	.65	.7	.7	1200
16	Before Adjust	10:00	120	70/63°	48%	4.0	29.5	.215	29.5	.240	.65	.7	.7	1200
	After Adjust													

TABLE 6.-2 EVEN DAY TABLE

Sheet 1 of 3

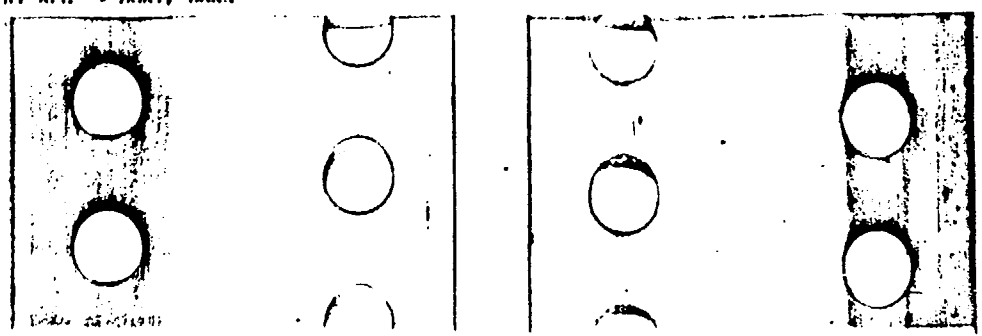
DATE 12/8/80 WITNESSED BY: GOV'T [signature] (Mask Only)
LINK [signature]
LIBRASCOPE [signature]

HOUR NO. Cont'd	TEST 5.4 CENTER & SIZE						TEST 5.5 REGISTRATION															
	CENTER (ARC-MIN)		LEFT (ARC-MIN)	RIGHT (ARC-MIN)	TOP (ARC-MIN)	BOTTOM (ARC-MIN)	PT. A HORIZ* REG (ARC-MIN)		PT. A VERT* REG (ARC-MIN)		PT. B HORIZ REG (ARC-MIN)		PT. B VERT REG (ARC-MIN)		PT. C HORIZ REG (ARC-MIN)		PT. C VERT REG (ARC-MIN)		PT. D HORIZ REG (ARC-MIN)		PT. D VERT REG (ARC-MIN)	
	H	V																				
1	ST		ART				0	0	0	2	0	0	1	3	0	0	0	2	0	0	0	2
2																						
3																						
4																						
5	+35	+15	-30	+25	-5	0	0	+2	5	8	0	0	+5	+6	0	0	+5	+5	+2	+2	+5	+5
6																						
7																						
8																						
9 Before Adj	+50	+20	-40	+40	0	-10	0	+2	+5	+5	0	0	+6	+8	0	+2	+5	+5	+2	+3	+5	+6
9 After Adj			START				0	-1	0	0	0	0	0	0	0	-2	0	0	0	-1	0	0
10																						
11																						
12																						
13	0	+15	-10 ~~+10~~	+10	0	-5	0	+5	0	0	-2	-2	0	0	0	0	0	0	0	+2	0	0
14																						
15																						
16 Before Adj	+25	+15	-15	+15	0	0	0	+5	0	0	0	-5	0	0	0	-3	0	0	0	+3	0	0
16 After Adj																						

* NOTE: HORIZ REG → VERT BARS VERT REG → HORIZ BARS

TABLE 6.-2 EVEN DAY TABLE

SHEET 2 of 3



'DATE: 12/8/06 WITNESSED BY: GOVT [illegible signature]
LINK [illegible signature]
LIBRASCOPE M. Marie / J. Border

HOUR NO. (CON'T)	TEST 5.6 RESOLUTION* FOCUS DIAL (DEG.)	HORIZ RES. (GROUP)	VERT RES. (GROUP)	ADJUSTMENTS MADE AT HOUR 9	ADJUSTMENTS MADE AT HOUR 16	COMMENTS
						SYSTEM TURNED ON 6:00 AM. MORNING READINESS START 6:30. TEST START 7:00 AM.
1	200° 15'	-1,3	-1,2			
2	200° 21'	-1,2	-1,2			
3	200° 27'	1,2	-1,1			10:05 PERISCOPE MIRROR MOVED
4	200° 21'	1.2	1.1			VIDEO SIG. FLUTTER DUE TO TOP PERISCOPE MIRROR
5	200° 9'	-1,3	-2,6			
6	199° 39'	-1,1	-2,85 NC			DELAY FOR 20 MIN FOR OUTSIDE UNRELATED MAINTANCE (water line to video system)
7						OUTSIDE UNRELATED MAINTANCE
8						BAD Registration
9 Before Adj	200° 30'	-1,3	-2,6	READJUST TOP PERISCOPE MIRROR ADJUST ACCOM POWER TO 4W READJUST R,G,Y DICHROIC MIRRORS INCREASED PRE AMP GAIN ON BLUE CHANNEL		
9 After Adj	200° 20'	-1,4	-1,1			
10	200° 20'	-1,4	-1,1			
11	200° 30'	-1,3	-1,2			
12	200° 15'	-1,3	-1,2			
13	200° 19'	-1,3	-1,2			
14	200° 17'	-1,3	-1,2			
15	200° 0'	-1,3	-1,2		NONE MADE	10:10 SHUT DOWN
16 Before Adj.	200 15'	-1,2	-1,2		BECAUSE UNNECESSARY	
16 After Adj.						

*NOTE - Horiz Res → Vert Bars
Vert Res → Horiz Bards

TABLE 6.-2 EVEN DAY TABLE (CONT'D)

DATE 12/9/80 WITNESSED BY: GOV'T [illegible] (Monitor Only)
LINK [illegible]
LIBRASCOPE [illegible]

HOUR NO.	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PWR OUTPUT: ARGON WATTS	ARGON AMPS	KRYPTON WATTS	KRYPTON AMPS	DYE WATTS	TEST 5.3 VIDEO LEVEL: V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HI VOLTAGE (VOLTS)
1	7:00 / 7:30	120	67°/62°	49%	4	30	.225	29.5	.220	.7	.65	.7	1200
2	8:00 / 8:10	120	68°/63°	50%									
3	9:00 / 9:10	120	67°/63°	50%	3.95	30	.225	29.5	.220	.63	.6	.7	1200
4	10:00 / 10:10	120	68°/62°	54%									
5	11:00 / 11:15	120	68°/62°	50%	3.95	29.5	.225	28	.220	~~[illegible]~~.6	.55	.7	1200
6	12:00 / 12:10	120	70°/63°	48%									
7	1:00 / [illegible]	120	64°/63°	47%	3.9	29.5	.225	28	.230	.5	.35	.85	1200
8	2:00 / 2:10	120	69°/63°	51%									
1st half of 9	3:00 / 3:10	120	69°/63°	59%	3.9	29.5	.240	29	.230	.5	.4	.5	1200
2nd half of 9	3:15 / 3:25	120	69°/63°	58%	4.0	30.0	.235	29	.230	.65	.7	.7	1200
10	4:00	120	69°/63°	59%									
11	5:00 / 5:05	120	69°/63°	58%	4.0	30.0	.230	29	.230	.65	.75	.70	1200
12	6:00	120	70°/64°	48%									
13	7:00 / 7:10	121	70°/64°	45%	4.0	30.0	.225	28.5	.225	.65	.70	.65	1200
14	8:00 / 8:05	121	70/63	48%									
15	9:16 / 9:20	120	70/63	48%	4.0	30.0	.230	29	.225	.65	.7	.65	1200
16 Before Adjust	9:55 / 10:00	121	70/63	48%	4.0	30.0	.225	29	.225	.60	.70	.65	1200
16 After Adjust													

TABLE 6.-1 ODD DAY TABLE

DATE 12/9/80 WITNESSED BY: GOV'T ______
LINK A. [illegible signature]
LIBRASCOPE [illegible signature]

HOUR NO. Cont'd	TEST 5.4 CENTER & SIZE: CENTER (ARC-MIN) X	CENTER Y	LEFT (ARC-MIN)	RIGHT (ARC-MIN)	TOP (ARC-MIN)	BOTTOM (ARC-MIN)	TEST 5.5 REGISTRATION: PT. A HORIZ* REG (ARC-MIN) RG	PT. A HORIZ* RB	PT. A VERT* REG (ARC-MIN) RG	PT. A VERT* RB	PT. B HORIZ REG (ARC-MIN) RG	PT. B HORIZ RB	PT. B VERT REG (ARC-MIN) RG	PT. B VERT RB	PT. C HORIZ REG (ARC-MIN) RG	PT. C HORIZ RB	PT. C VERT REG (ARC-MIN) RG	PT. C VERT RB	PT. D HORIZ REG (ARC-MIN) RG	PT. D HORIZ RB	PT. D VERT REG (ARC-MIN) RG	PT. D VERT RB
1	←		START			→	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0
2																						
3																						
4																						
5	+35	-5	-25	+25	-5[illegible]	+10	0	0	+1	0	+1	0	+2	+2	+2	0	0	0	+1	+1	+2	0
6																						
7																						
8																						
9 Bef	+30	+10	-30	+30	-5	+15	0	0	+4	+4	-1	-1	+4	+4	0	0	+3	+3	0	0	+3	+3
aft	+30	+10	-30	+30	-5	+15	0	0	+4	+4	-1	-1	+4	+4	0	0	+3	+3	0	0	+3	+3
10																						
11																						
12																						
13	+28	+10	-30	+25	0	-10	-3	-2	0	0	0	-3	0	0	-2	-2	0	0	0	0	+2	0
.																						
15																						
16 Before Adj	+35	+10	-35	+30	0	-15	0	0	0	0	0	-3	0	0	-2	-2	0	0	-1	-2	+2	0
After Adj																						

*NOTE: HORIZ REG → VERT BARS VERT REG → HORIZ BARS

TABLE 6.-1 ODD DAY TABLE (CONT'D)

DATE: 1-19-80

WITNESSED BY: GOVT.
LINK M. Eland
LIBRASCOPE Mansie

HOUR NO. (CON'T)	TEST 5.6 RESOLUTION* FOCUS DIAL (DEG.)	HORIZ RES. (GROUP)	VERT RES. (GROUP)	ADJUSTMENTS MADE AT HOUR 16	COMMENTS
1	200° 34'	-1.3	-1.2		
2	200° 19'	-1.3	-1.2		Intermittent Heading jumps; heading servo in probe jumps but goes away
3	200° 15'	-1.4	-1.2		
4	200° 19'	-1,4	-1,2		
5	199° 42'	-1,3	-1,1		
6	200° 6'	-1,3	-1,2		
7	200° 27'	-1,3	-2,6		REGISTRATION BAD IN VERTICAL GREEN V. SIGNAL LOW
8	200° 15'	-1.2	-2.6		
9 Bef.	200° 12'	-1,3	-2,6	ADJUST PERISCOPE MIRROR; Blue; yellow dichroics	Registration very bad. We felt it not usable data to continue in that state.
aft	200° 14'	-1,3	-1,1	RESET PREAMP GAIN GREEN & BLUE	Installed Beam angle servo
10	200° 9'	-1,4	-1,1		
11	200° 8'	-1,5	-1,1		
12	200° 6'	-1,3	-1,2		
13	~~20~~ 199° 52'	-1,4	-1,1		
14	200° 13'	-1.5	-1.1		
15	200° 8'	-1.3	-1.2		
16 Before Adj.	199° 52'	-1.3	-1.1	NONE NECESSARY	10:00 SHUT DOWN
After Adj.					

*NOTE - Horiz Res → Vert Bars
Vert Res → Horiz Bars

TABLE 6.-1 ODD DAY TABLE (CON'T)

SHEET 3 of 3

DATE 12-10-80 WITNESSED BY: GOV'T Robert Ferguson ("Monitor Only")
LINK Mark Edmund
LIBRASCOPE John Borden

HOUR NO.	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PWR OUTPUT ARGON WATTS	ARGON AMPS	KRYPTON WATTS	KRYPTON AMPS	DYE WATTS	TEST 5.3 VIDEO LEVEL V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HI VOLTAGE (VOLTS)
1	8:00 / 8:15	120	68°/65°	54%	4	31.5	.250	29.5	.220	.7	.7	.7	1200
2	9:00	120	68°/63°	50%									
3	10:00 / 10:15	120	68°/65°	50%	4	31	.220	29	.220	.75	.65	.7	1200
4	11:00 / 11:15	120	69°/65°	48%									
5	12:00 / 12:15	120	70°/65°	45%	4	31	.220	29	.220	.7	.6	.7	1200
6	1:00	120	72°/63°	42%									
7	2:00 / 2:15	120	71°/64°	45%	39.5	31	.220	29	.220	.7	.5	.6	1200
8	3:00 / 3:10	121	72°/64°	49%									
9 Before Adj	4:00 PM	122	73°/60°	48%	3.95	31	.220	29	.220	.7	.4	.7	1200
9 After Adj													
10			Trouble Period										
11			Argon Laser Instability										
12			Due to low gas – maybe Angle for stability										
13													
14	9:00	121	71°/66	45%	~~4.0~~	~~30a~~	~~.225~~	~~29.5~~	~~.215~~	.7	.7	~~.7~~	~~1200~~
15	10:00	121	72/66	42%	4.0	30a	.210	29.5	.220	.7	.7	.7	1200
16 Before Adjust	11:00	121	72/66	43%	4.0	30a	.215	29.5	.215	.6	.7	.7	1200
16 After Adjust													

TABLE 6.-2 EVEN DAY TABLE

Sheet 1 of 3

DATE 12-10-80 WITNESSED BY: GOV'T ______

LINK Mark Elrod

LIBRASCOPE John Borden

HOUR NO. Cont'd	TEST 5.4 CENTER & SIZE					TEST 5.5 REGISTRATION							
						PT. A		PT. B		PT. C		PT. D	
	CENTER ↑+ →+ (ARC-MIN)	LEFT +← (ARC-MIN)	RIGHT →+ (ARC-MIN)	TOP ↑+ (ARC-MIN)	BOTTOM ↓+ (ARC-MIN)	HORIZ* REG (ARC-MIN) RG KB	VERT* REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN) RG KB
1	←	STA	RT →			0 / 0	0 / 0	0 / -1	0 / +1	-2 / 0	0 / -1	0 / 0	0 / 0
2													
3													
4													
5	50, 0	-20	+20	-5	~~-70~~ -5	0 / 0	+5 / 0	0 / +5	-5 / 0	0 / +5	-5 / 0	0 / +1	+1 / +1
6													
7 2:00													
8													
9 Before Adj	+10, +10	-10	+10	+10	-10	0 / 0	+5 / 0	0 / 0	+5 / 0	0 / +5	-5 / 0	0 / +1	+1 / +1
9 After Adj		Readjusted —											
10													
11													
12													
13													
14 9:00													
15 10:00													
16 Before Adj	115 / +5	Not	calibrated			0 / 0	0 / +5	0 / 0	0 / +3	0 / 0	0 / 0	0 / 0	+1 / +1
16 After Adj													

* NOTE: HORIZ REG → VERT BARS   VERT REG → HORIZ BARS

TABLE 6.-2 EVEN DAY TABLE

DATE: 12-10-80 WITNESSED BY: GOVT ____

LINK [signature]

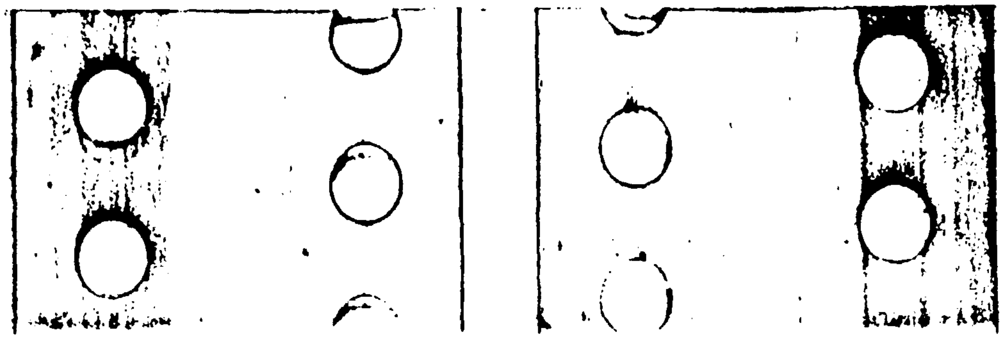
LIBRASCOPE [signature]

HOUR NO. (CON'T)	TEST 5.6 RESOLUTION* FOCUS DIAL (DEG.)	HORIZ RES. (GROUP)	VERT RES. (GROUP)	ADJUSTMENTS MADE AT HOUR 9	ADJUSTMENTS MADE AT HOUR 16	COMMENTS
1	200° 58'	-1.4	-1.2			BEAM ANGLE SERVO ADJ. RELATE. [illegible]
2	200° 39'	-1.4	1.2			(VIDEO LEVELS DROPPED
3	200° 28'	-1,4	-1,1			TO .3 V overnight)
4	200° 15'	-1,3	-1,1			
5	200° 42'	-1.4	-1.1			
6	200° 54'	-1 3	-1.1			
7 2.00	200° 42'	-1 4	-1,1			
8	200° 42'	-1,3	-2,6 mt			
9 Before Adj	200° 30'	-1,3	-1.1	Adjusted green gain for D.T.V.		Finally after much [illegible] the problem was an instability LT
9 After Adj				Checked Tube convergence		in the Argon laser - readjusted Argon laser +
10				-very poor- made things worse by		restarted [illegible] at 8:35
11				attempting to converge.		Equipment [illegible] beam wander
12				green signal improved to 1.0 V. readjusted back		Argon when [illegible] causing [illegible]
13				to 0.7 - Another attempt at convergence		registration -
14	200° 26'	-1,2	-1,2			
15	200° 01'	-1,3	-1,2			Blue Registration shift 2-3 min up vertical
16 Before Adj.	200° 21'	-1,3	-1,2			Small Blue misregistration
16 After Adj.	Not	Performed.				drift vertical

*NOTE - Horiz Res → Vert Bars
Vert Res → Horiz Bards

TABLE 6.-2 EVEN DAY TABLE (CONT'D)

SHEET 3 of 3



DATE 12-11-80 WITNESSED BY: GOV'T ______
LINK [illegible]
LIBRASCOPE [illegible]

HOUR NO.	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PWR OUTPUT ARGON WATTS	ARGON AMPS	KRYPTON WATTS	KRYPTON AMPS	DYE WATTS	TEST 5.3 VIDEO LEVEL V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HI VOLTAGE (VOLTS)
1	8:19 / 8:30	120	69°/65°	55%	4	30	.235	29	.230	.7	.7	.7	1200
2	9:19 / 9:30	120	70°/65°	48%									
3	10:19 / 10:20	120	70°/66°	44%	4	30	.225	29	.220	.7	.7	.7	1200
4	11:09	120	71°/65°	45%									
5	12:09 / 12:20	120	72°/66°	42%	4	30	.225	29	.220	.6	.65	.7	1200
6	1:00 / 1:12	120	72°/66°	49%									
7	2:00 / 2:10	120	72°/66°	49%	4	30	.220	29	.220	.7	.6	.6	1200
8	3:10 / 3:15	120	72°/66	49%									
9	4:10	120	72°/65	49%	4	30	.225	29	.230	.65	.6	.7	1200
10	5:10	120	72°/65°	49%									
11	6:10 / 6:23	120	72°/66°	42%	4	30	.215	29	.225	.65	.6	.7	1200
12	7:10 / 7:11	120	72°/65°	49%									
13	8:10 / 8:11	121	72°/66°	49%	4	30	.210	29	.220	.65	.7	.75	1200
14	9:10 / 9:13	119	72/66	42%									
15	10:06 / 10:07	126	72/66	42%	4	31	.210	29	.220	.7	.7	.75	1200
Before Adjust	10:55 / 11:0	120	71/66	49%	4	31	.205	29	.220	.7	.7	.7	1200
After Adjust													

TABLE 6-1 ODD DAY TABLE

SHEET 1 of 1

DATE 12-11-80 WITNESSED BY: GOV'T
LINK Mark Omark
LIBRASCOPE John Borden

HOUR NO. Cont'd	TEST 5.4 CENTER & SIZE: CENTER ↑+ →+ (ARC-MIN)	LEFT +← (ARC-MIN)	RIGHT →+ (ARC-MIN)	TOP ↑+ (ARC-MIN)	BOTTOM ↓+ (ARC-MIN)	TEST 5.5 REGISTRATION: PT. A HORIZ* REG (ARC-MIN)		PT. A VERT* REG (ARC-MIN)		PT. B HORIZ REG (ARC-MIN)		PT. B VERT REG (ARC-MIN)		PT. C HORIZ REG (ARC-MIN)		PT. C VERT REG (ARC-MIN)		PT. D HORIZ REG (ARC-MIN)		PT. D VERT REG (ARC-MIN)	
1	START					0	0	0	0	-2	1	0	1	-2	0	0	0	0	0	+2	0
2																					
3																					
4																					
5	+4, 0	+2	-3	0	0	0	1	0	0	0	-1	-2	0	-2	0	0	-1	0	-1	+2	-2
6																					
7																					
8																					
9	+8, +4	-5	+4	0	0	0	0	0	0	0	0	-2	0	0	0	0	0	0	0	+2	0
10																					
11																					
12																					
13	+10, +5	-15	0	-5	-5	0	0	+4	0	0	0	+4	0	0	0	0	0	-2	0	0	0
14																					
15																					
16 Before Adj	+8, 0	-15	0	-5	0	-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1
After Adj																					

* NOTE: HORIZ REG → VERT BARS VERT REG → HORIZ BARS

TABLE 6.-1 ODD DAY TABLE (CONT'D)

DATE: 12-11-80 WITNESSED BY: GOVT
LINK [illegible]
LIBRASCOPE [illegible]

HOUR NO. (CON'T)	TEST 5.6 RESOLUTION* FOCUS DIAL (DEG.)	HORIZ RES. (GROUP)	VERT RES. (GROUP)	ADJUSTMENTS MADE AT HOUR 16	COMMENTS
1	200° 48'	-1.4	-1.2		
2	200° 51'	-1.4	-1.2		
3	200° 18'	-1.3	-1.2		
4	200° 45'	-1.3	-1.1		
5	200° 0'	-1.3	-1.1		
6	200° 9'	-1.4	-1.1		
7	200° 25'	-1.3	-1.2		
8	200° 10'	-1.3	-1.1		
9	200° 2'	-1.3	-1.1	~~Alot~~	
10	200° 25'	-1.3	-1.1		
11	200° 15'	-1.3	-1.2		
12	200° 0'	-1.3	-1.1		Re.adj top periscope mirror to boost video levels
13	200° 28'	-1.4	-1.1		
14	200° 33'	-1.4	-1.2		
15	200° 36'	-1.4	-1.2		
16 Before Adj.	200° 30'	-1.3	-1.2	NONE	SHUT DOWN 11:01
16 After Adj.					

*NOTE - Horiz Res ⇒ Vert Bars
Vert Res ⇒ Horiz Bars

TABLE 6.-1 ODD DAY TABLE (CON'T)

DATE 12/12/80 WITNESSED BY: GOV'T ______
LINK ______
LIBRASCOPE Marie/Banks

HOUR NO.		TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PWR OUTPUT ARGON WATTS	ARGON AMPS	KRYPTON WATTS	KRYPTON AMPS	DYE WATTS	TEST 5.3 VIDEO LEVEL V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HI VOLTAGE (VOLTS)
1		9:00/9:15	120	70°/66°	40%	4	31.5	.235	24	~~.210~~ .185	.7	.7	.7	1200
2		10:0/10:15	120	72°/66°	48%									
3		11:00/11:10	120	72°/66°	48%	4	31	.235	24	.185	.7	.7	.8	1200
4		12:00/12:08	120	72/66	45%									
5		1:00/1:10	120	72°/66°	45%	4	31	.235	24	.170	.7	.7	.75	1200
6		2:00/2:10	120	72°/66°	40%									
7		3:00	120	70°/66°	42%	4	31	.255	24.5	.180	.7	.5	.6	1200
8		4:00	120	72°/66°	42%									
9	Before Adj	5:00	120	72/66	42%	4	32	.250	25	.180	.65	.7	.7	1200
	After Adj													
10														
11														
12														
13														
14														
15														
16	Before Adjust													
	After Adjust													

Scrubbed - Air Syst Problem
DRC

TABLE 6.-2 EVEN DAY TABLE

Sheet 1 of 3

DATE: 12/12/80 WITNESSED BY: GOVT ______
LINK ______
LIBRASCOPE Marie / Bender

HOUR NO. (CON'T)	TEST 5.6 RESOLUTION* FOCUS DIAL (DEG.)	HORIZ RES. (GROUP)	VERT RES. (GROUP)	ADJUSTMENTS MADE AT HOUR 9	ADJUSTMENTS MADE AT HOUR 16	COMMENTS
1	200° 33'	-1.3	-1.2			
2	200° 24'	-1.3	-1.2			
3	200° 51'	-1.3	-1.2			
4	200° 24'	-1.3	-1.1			
5	200° 36'	-1.3	-1.2			
6	200° 59'	-1.2	-1.2			
7	200° 14'	-1.3	-1.1			Adjusted Arrowtable beam that was bumped during focus
8	200° 36'	-1.2	-1.1			measurements R G & B video levels are back to .7
9 Before Adj	200° 21'	-1.2	-1.1			Registration poor -
9 After Adj						5:15 P.M. - Air supply (compressor) stopped - lost air - spinner stopped.
10						Traced problem to air compressor motor controller - thermal protect
11						out. Restarted air compressor. pressure would only come to
12						135 PSI with spinner valve open (the) closed the spinner
13						air valve - Air compressor went to 200 PSI + shut the
14						speed valve - 10 min to 150 psi. Restarted system and started
15						aligning. Ran about 5 min and air pressure dropped to
16 Before Adj.						100 PSI. Compressor would not bring up. - Shut down all
16 After Adj.						at 9:30

*NOTE - Horiz Res ⇒ Vert Bars
Vert Res ⇒ Horiz Bards

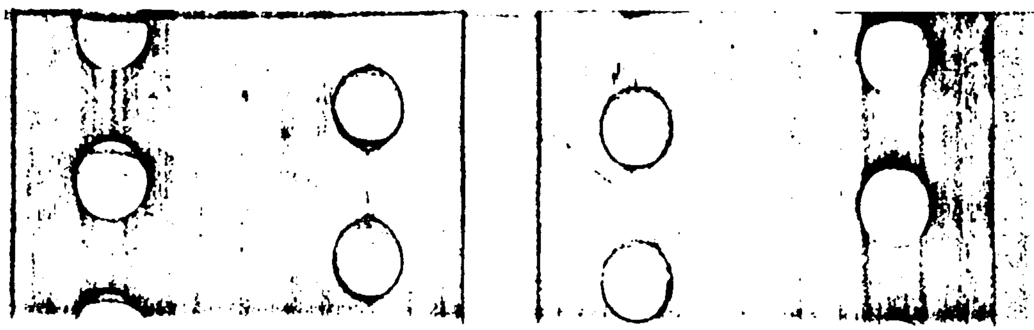
TABLE 6.-2 EVEN DAY TABLE (CONT'D)

DATE 12-12-80 WITNESSED BY: GOV'T [illegible]
LINK
LIBRASCOPE [illegible]

HOUR NO. Cont'd	TEST 5.4 CENTER & SIZE: CENTER (ARC-MIN)	LEFT (ARC-MIN)	RIGHT (ARC-MIN)	TOP (ARC-MIN)	BOTTOM (ARC-MIN)	TEST 5.5 REGISTRATION: PT. A HORIZ* REG (ARC-MIN) RG	RB	PT. A VERT* REG (ARC-MIN) RG	RB	PT. B HORIZ REG (ARC-MIN)		PT. B VERT REG (ARC-MIN)		PT. C HORIZ REG (ARC-MIN)		PT. C VERT REG (ARC-MIN)		PT. D HORIZ REG (ARC-MIN) RG	RB	PT. D VERT REG (ARC-MIN) RG	RB
1		START				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2																					
3																					
4																					
5	-2,1	0	-2	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0
6																					
7																					
8																					
9 Before Adj	+2,2	-1	+2	0	0	+1	0	+1	+4	+0	+0	0	+4	+1	+0	+0	+4	0	+1	+1	+4
9 After Adj																					
10																					
11																					
12																					
13																					
14																					
15																					
16 Before Adj																					
16 After Adj																					

* NOTE: HORIZ REG → VERT BARS VERT REG → HORIZ BARS

TABLE 6.-2 EVEN DAY TABLE



DATE 12/1/80 WITNESSED BY: GOV'T Robert Ferguson (Monitor Only)
LINK Mark Edwards
LIBRASCOPE John Border

HOUR NO.	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PWR OUTPUT: ARGON WATTS	ARGON AMPS	KRYPTON WATTS	KRYPTON AMPS	DYE WATTS	TEST 5.3 VIDEO LEVEL: V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HT VOLTAGE (VOLTS)
1	7:00	120	70	64	4.0	31	275 mw	27.5	.180	.70	.70	.73	1200 V
2	8:00	120	70	64									
3	9:00	120	70	69	4.0	31	275 mw	27.5	.200	.70	.70	.70	1200 V
4	10:00	120	72	57									
5	11:00	120	71	61	4.0	31	275 mw	27.5	.200	.70	.60	.65	1200 ✓
6	12:00	120	72	65									
7	1:00	120	73	61	4.0	31	275 mw	27.5	.200	.70	.65	.73	1200
8	2:00	120	74	58									
9	3:00	120	73	53	4.0	30	275 mw	27.5	.200	.60	.50	.50	1200
10	4:00	SEE COMMENTS											
11	5:00												
12	6:00	120	72	50	4.0	30.5	275 mw	29.0	210 mw	.70	.70	.75	1200
13	7:00	120	73	50									
14	8:00	120	78	46	4.0	30.5	275 mw	29.0	210 mw	.45	.40	.60	1200
15	9:00	120	79	35	3.9	30.7	250 mw	28.5	210 mw	.40	.40	.50	1200
16 Before Adjust	10:00	120	78	44	3.9	31.0	255 mw	29.0	210 mw	.60	.50	.50	1200
16 After Adjust	10:20	120	78	44									

SHEET 1 of 3

TABLE 6.-1 ODD DAY TABLE

DATE 12/1/80 WITNESSED BY: GOV'T Robert Ferguson (Monitor Only)
LINK Mark Amundsen
LIBRASCOPE John Borden

HOUR NO. Cont'd	TEST 5.4 CENTER & SIZE					TEST 5.5 REGISTRATION							
						PT. A		PT. B		PT. C		PT. D	
	CENTER (ARC-MIN)	LEFT (ARC-MIN)	RIGHT (ARC-MIN)	TOP (ARC-MIN)	BOTTOM (ARC-MIN)	HORIZ* REG (ARC-MIN)	VERT* REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)
1	—	START	—	—	—	0 | 0	0 | 0	+1 | 0	0 | -1	0 | 0	0 | 0	+1 | -1	-1 | 0
2													
3													
4													
5	0	0	0	0	0	0 | 0	0 | 0	+1 | 0	0 | -1	-2 | 0	-1 | 0	0 | -1	-2 | 0
6													
7													
8													
9													
10													
11													
12													
13	—	3RT 2UP	1RT 1UP	2UP 2UP	NO MARKS	0 | 0	3UP | 2UP	0 | 0	2UP | 2UP	0 | 0	0 | 0	0 | 0	2UP | 2UP
14													
15													
16 Before Adj	~~[illegible]~~	5LT 5UP	6LT 5UP	3UP 5UP	NO MARKS	2IN | 3IN	3UP | 2UP	0 | 2IN	2UP | 2UP	0 | 0	2UP | 2UP	2IN | 3IN	3UP | 2UP
After Adj	POWER KNOCKED OFF BY GUARD UNABLE TO MEASURE					0 | +1	0 | 0	0 | -1	0 | 0	0 | 0	0 | 0	0 | 1	0 | 0

* NOTE: HORIZ REG → VERT BARS VERT REG → HORIZ BARS

TABLE 6.-1 ODD DAY TABLE (CONT'D)

DATE. 12/1/80 WITNESSED BY: GOVT [illegible signature] (Maint. Ofc.)
LINK [illegible signature]
LIBRASCOPE John Bordon

HOUR NO. (CON'T)	TEST 5.6 RESOLUTION* FOCUS DIAL (DEG.)	HORIZ RES. (GROUP)	VERT RES. (GROUP)	ADJUSTMENTS MADE AT HOUR 16	COMMENTS
1	201° 18'	- 1.3	- 1.2		NO. 1 ADDED TO GREEN
2	201° 3'	- 1.4	- 1.2		
3	201° 27'	- 1.3	- 1.2		
4	201° 12'	1.3	- 1.2		RESTART SPINNER (10:00)
5	201° 18'	1.3	- 1.2		RESTART SPINNER (11:10)
6	201° 15'	1.3	- 1.2		
7	201° 45'	1.3	- 1.2		RESTART SPINNER (1:45)
8	200° 33'	- 1.3	- 1.1		RESTART SPINNER (2:03), AND (2:40)
9					INTENSITY FLUTTER ON WHITE BACKGROUND DUE TO TOP PERISCOPE MIRROR DRIFT
10					OFF AT 3:[illegible] PM SPINNER GOING OUT OF SYNC. PROBLEM TRACED TO BAD CONNECTOR. ATTEMPTED FIX - BENDING PINS DAMAGED PIN 20. RESOLDERED WIRES. [illegible] RESTART 5:15 PM
11					
12	200° 54'	- 1.3	- 1.2		6:18 SPINNER SHUT DOWN: BAD CONNECTOR ON CARD [illegible] RESTART 6:35
13	200° 50'	- 1.3	- 1.2		7:30 SPINNER SHUT DOWN RESTART 7:31 / AT 8:00 NOTICED AIR CONDITIONER SHUT DOWN
14	200° 45'	- 1.1	- 1.1		
15	200° 35'	- 2.5	- 2.5		
16 Before Adj.	199° 24'	VERY BAD	VERY BAD	ADJ. BEAM POINTING MIRROR ADJ. BLUE, GG, YELLOW REG.	UNABLE TO OBSERVE ACCURATE RESOLUTION DUE TO LOUSY CONVERGENCE
16 After Adj.	200° 15'	- 1.3	- 1.2		END TEST 10:30 PM

*NOTE - Horiz Res ⇒ Vert Bars
Vert Res ⇒ Horiz Bars

TABLE 6.-1 ODD DAY TABLE (CON'T)

SHEET 3 of 3

DATE 12-2-80 WITNESSED BY: GOV'T Robert Ferguson (Mastr. Auf.)
LINK Mark Almonder
LIBRASCOPE John Borden

HOUR NO.	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PWR OUTPUT ARGON WATTS	ARGON AMPS	KRYPTON WATTS	KRYPTON AMPS	DYE WATTS	TEST 5.3 VIDEO LEVEL V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HI VOLTAGE (VOLTS)
1	7:10	120	68°/64°	62%	4	31	.275	29	.200	.7	.8	.8	1200
2	8:10	120	68°/69°	58%									
3	9.14	120	68°/69°	54%	4	29	.275	29.5	.200	.6	.85	.7	1200
4	10.12	120	68°/69°	54%									
5	11:12	120	68°/69	54%	4	29	.275	29.5	.200	.6	.7	.7	1200
6	12:12	120	68°/69	54%									
7	1:11	120	70°/69	55%	4	31	.275	28.0	.200	.6	.7	.7	1200
8	2:11	120	70°/69°	55%									
9 Before Adj	3:14	120	70°/68°	59%	4	31	.260	28.5	.215	.6	.75	.7	1200
9 After Adj													
10													
11													
12										.7	.8	.8	1
13													
14		123	70/62	64%									
15	9:10	122	70/60	55%	3.9	31.2	.260	28.5	.205	.55	.50	.50	1200
16 Before Adjust			70/62	64%	4.0	31.2	.260	28.7	.200	.55	.45	.45	1200
16 After Adjust		122	70/62	64%	4.0	31.2	.260	28.5	.205	.70	.70	.65	1200

TABLE 6.-2 EVEN DAY TABLE

Sheet 1 of 3

DATE 12-2-80 WITNESSED BY: GOV'T [illegible signature] (Monitor Chf)
LINK [illegible signature]
LIBRASCOPE John Borden

HOUR NO. Cont'd	TEST 5.4 CENTER & SIZE					TEST 5.5 REGISTRATION							
						PT. A		PT. B		PT. C		PT. D	
	CENTER (ARC-MIN)	LEFT (ARC-MIN)	RIGHT (ARC-MIN)	TOP (ARC-MIN)	BOTTOM (ARC-MIN)	HORIZ* REG (ARC-MIN) RG RB	VERT* REG (ARC-MIN) RG RB	HORIZ REG (ARC-MIN) RG RB	VERT REG (ARC-MIN) RG RB	HORIZ REG (ARC-MIN) RG RB	VERT REG (ARC-MIN) RG RB	HORIZ REG (ARC-MIN) RG RB	VERT REG (ARC-MIN) RG RB
1	←	S	T	A	R T →	0 0	0 -1	-1 -1	0 0	0 -1	0 -1	+1 +1	0 0
2													
3													
4													
5	+1, 0	+1	-1	+1	-1	0 0	0 -2	-1 -1	0 1	0 -2	0 -2	0 +1	0 -1
6													
7													
8													
9 Before Adj	35, 0	-1	+20	0	0	0 -4	-1 0	0 -5	0 0	-1 -1	0 0	0 -2	0 0
9 After Adj													
10													
11													
12													
13													
14													
15													
16 Before Adj													
16 After Adj													

*NOTE: HORIZ REG → VERT BARS VERT REG → HORIZ BARS

TABLE 6.-2 EVLN DAY TABLE

SHEET 2 of 3

DATE: 12-2-80 WITNESSED BY: GOVT [illegible]
LINK [illegible]
LIBRASCOPE [illegible]

HOUR NO. (CON'T)	TEST 5.6 RESOLUTION* FOCUS DIAL (DEG.)	HORIZ RES. (GROUP)	VERT RES. (GROUP)	ADJUSTMENTS MADE AT HOUR 9	ADJUSTMENTS MADE AT HOUR 16	COMMENTS
1	201° 12'	- 1.4	- 1.2			
2	200° 45'	- 1.3	- 1.2			
3	200° 55'	- 1.3	- 1.2			
4	201° 15'	- 1.3	- 1.2			
5	201° 12'	- 1.3	- 1.2			
6	201° 12'	- 1.3	- 1.2			
7	201° 0'	- 1.3	- 1.2			
8	201° 0'	- 1.3	- 1.2			
9 Before Adj	201° [illegible]3'	- 1.4	- 1.1			
9 After Adj		-	-			
10						
11						
12		- 1	-			
13		-	-			
14	200° 12'	- 1.3	- 1.1			LIGHT LEVELS DRIFTED R 55 G 5 B 5
15	200° 6'	- 1.3	- 1.1			
Before Adj.						
After Adj.						

*NOTE - Horiz Res → Vert Bars
Vert Res → Horiz Bards

TABLE 6.-2 EVEN DAY TABLE (CONT'D)

SHEET 3 of 3

DATE 12/3/80 WITNESSED BY: GOV'T [illegible] (Mate Only)
LINK [illegible]
LIBRASCOPE M. [illegible]

HOUR NO.	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PWR OUTPUT ARGON WATTS	ARGON AMPS	KRYPTON WATTS	KRYPTON AMPS	DYE WATTS	TEST 5.3 VIDEO LEVEL V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HI VOLTAGE (VOLTS)
1	9:30	120	69/63	68%	4.0	(31.5) 37.5	.265	29	.060/.200	.70	.70	.70	1200
2	10:30	120	70/62	64%									
3	11:30	120	69/63	59%	4.1	31.5	.265	29	.205	.70	.75	.70	1200
4	12:30	120	70/63	59%									
5	1:30	120	70/64	55%	4.1	33.5	.270	29	.200	.70	.70	.6	1200
6	2:30	120	70/63	55%									
7	3:30	120	72/64	61%	4.1	33.2	.260	29.	.200	.70	.70	.6	1200
8	4:30	120	72/62	55%	4.1	33.0	.250	29	.200	.7	.7	.6	1200
9	[illegible]	120	70/[illegible]	64%	4.1	[illegible]	.260	29	.210	.7	.7	.6	[illegible]
10	6:30	120	71/[illegible]	[illegible]									
11	7:30	120	71/63	55%	4.1	34	.250	29.5	.210	.69	.7	.65	1200
12	8:30	120	70/62	57%									
13	9:30	120	71/64	64%	4.1	34.2	.255	29.5	.205	.66	.7	.60	1200
14	10:30	120	71/64	64%									
15	11:30	120	71/64	64%	4.1	34.7	.255	29	.205	.65	.7	.62	1200
Before Adjust	12:30	120	71/62	55%	4.1	34.5	.250	29	.205	.70	.7	.63	1200
After													

DATE 12/3/80 WITNESSED BY: GOV'T [signature] (Mitre Corp)
LINK [signature]
LIBRASCOPE [signature]

HOUR NO. Cont'd	TEST 5.4 CENTER & SIZE					TEST 5.5 REGISTRATION							
						PT. A		PT. B		PT. C		PT. D	
	CENTER (ARC-MIN)	LEFT (ARC-MIN)	RIGHT (ARC-MIN)	TOP (ARC-MIN)	BOTTOM (ARC-MIN)	HORIZ* REG (ARC-MIN)	VERT* REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)
1	START					0 / 0	0 / 0	-2 / 0	0 / 0	-2 / -2	0 / 0	0 / 0	0 / 0
2													
3													
4													
5	+5, 0	-2	-2	0	0	0 / -1	0 / 0	-2 / -1	0 / +1	-2 / 0	0 / +1	0 / 0	+1 / +1
6													
7													
8													
9	←	[illegible]	[illegible]			-1 / -2	+1 / 0	-1 / -1	0 / 0	-1 / 0	0 / 0	0 / +2	0 / 0
10													
11													
12													
13	[illegible] / +7	-5	+5	0	+10	0 / +2	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / +2	-2 / 0
14													
15													
16 Before Adj	0 / 17	0	0	+2	+10	0 / +2	+2 / +2	-2 / -2	0 / 0	0 / 0	0 / 0	0 / 0	-2 / +2
After Adj													

* NOTE: HORIZ REG → VERT BARS VERT REG → HORIZ BARS

TABLE 6.-1 ODD DAY TABLE (CONT'D)

DATE: 12/3/80 WITNESSED BY: GOVT [illegible] (Monitor Adj.)

LINK [illegible]

LIBRASCOPE [illegible]

HOUR NO. (CON'T)	TEST 5.6 RESOLUTION* FOCUS DIAL (DEG.)	HORIZ RES. (GROUP)	VERT RES. (GROUP)	ADJUSTMENTS MADE AT HOUR 16	COMMENTS
1	200°57'	-1,4	-1,1		ADJUSTED PUMPING BEAM INTO DYE LASER ([illegible]) (.200) [illegible] become a damaged (burned) near cavity [illegible] mirror was discovered. Mirror rotated to get beam off of burned spot. Subsequent [illegible] realignment.
2	200°52'	-1,4	-1,1		
3.	200°56'	-1,4	-1,1		
4	200°56'	-1,4	-1,1		
5	200°56'	-1,4	-1,1		
6	201°17'	-1,4	-1,1		
7	200°57'	-1,4	-1,2		
8	201° [illegible]'	-1,4	-1,2		None, 45C
9	200° [illegible]'	-1,2	-1,1		None
10	200° 59'	-1,3	-1,2		None
11	200° 57'	-1.3	-1.2		None
12	200° 54'	-1.3	-1.2		None
13	200° [illegible]'	-1.3	-1.2		None
14	200° [illegible]'	-1.3	-1.2		None
15	200° [illegible]'	-1.2	-1.2		None
16 Before Adj.	[illegible]	-1.3	-1.2		Readjustments not needed - not made
After Adj.					

*NOTE - Horiz Res ⇒ Vert Bars,
Vert Res ⇒ Horiz Bars

TABLE 6.-1 ODD DAY TABLE (CON'T)

SHEET 3 of 3

Heading 3° 47'
Pitch 20° 41'
Roll 8° 36'
Focus 20° 27'

DATE 12/4/80 WITNESSED BY: GOV'T [signature] (Mitre Corp)
LINK [signature]
LIBRASCOPE [signature]

HOUR NO.	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PWR OUTPUT: ARGON WATTS	ARGON AMPS	KRYPTON WATTS	KRYPTON AMPS	DYE WATTS	TEST 5.3 VIDEO LEVEL: V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HI VOLTAGE (VOLTS)
1	9:30	120 ✓	72°/64°	69%	3.8	32.5	.260	29	.030	.7	.2	.4	1200
2	10:30	121 ✓	70°/62°	64%									
3	11:30	SEE	COMMENTS										
4	12:30	120 ✓	71°/65	68%									
5	1:30	120 ✓	70°/64°	64%	3.7	35	.255	29	.180	.6	.6	.7	1200
6	2:30	120 ✓	70°/64	64%									
7	3:30	121 ✓	72°/64	65%	3.9	34	.265	29	.212	.6	.6	.6	1200
8	4:30	123	[illegible]	63%						.6	.6	.6	1200
9 Before Adj	5:30	120 ✓	[illegible]	63%	4.0	34.5	.255	29	.205	.6	.7	.6	1200
9 After Adj	6:05	121 ✓	72°/63	65%	4.0	35.0	.250	29	.205	.6	.6	.5	1200
10	6:30	121	70/63	64%									
11	7:30	120 ✓	71/64	64%	4.0	36	.240	28.5	.200	.6	.6	.5	1200
12	8:30	121	70/64	68%									
13	9:30	120	70/64	64%	3.9	36.5	.240	28.5	.185	.6	.6	.5	1200
14	10:30	120	70/64	64%									
15	11:30	120	71/64	64%	3.85	35.2	.230	28.5	.160	.6	.55	.45	1200
16 Before Adjust	12:02	See		Com	ments								
16 After Adjust													

TABLE 6.-2 EVEN DAY TABLE

Sheet 1 of 3

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DATE 12/4/80 WITNESSED BY: GOV'T [illegible] (Monitor Only). LINK [illegible] LIBRASCOPE M. [illegible]

HOUR NO. Cont'd	TEST 5.4 CENTER & SIZE: CENTER ↑+ →+ (ARC-MIN)	LEFT +← (ARC-MIN)	RIGHT →+ (ARC-MIN)	TOP ↑+ (ARC-MIN)	BOTTOM ↓+ (ARC-MIN)	TEST 5.5 REGISTRATION: PT. A HORIZ* REG (ARC-MIN)	PT. A VERT* REG (ARC-MIN)	PT. B HORIZ REG (ARC-MIN)	PT. B VERT REG (ARC-MIN)	PT. C HORIZ REG (ARC-MIN)	PT. C VERT REG (ARC-MIN)	PT. D HORIZ REG (ARC-MIN)	PT. D VERT REG (ARC-MIN)
1		START				0 | -1	0 | 0	-1 | -2	0 | 0	0 | 0	0 | 0	0 | -1	0 | 0
2													
3													
4													
5	-20 | +20	-15	+15	+5	+5	0 | -1	0 | 0	-1 | -2	0 | 0	0 | 0	0 | 0	0 | 0	0 | 0
6													
7													
8						[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0 | 0	-2 | 0	+2 | +1
9 Before Adj	old	marks	not	calibrated	because of	0 | 0	0 | 0	0 | 0	0 | 0	0 | 0	0 | 0	0 | 0	0 | 0
9 After Adj	-5 | 3	-10	-10	0	-5								
10													
11													
12													
13	0 | -20	0	0	-5	0	0 | 0	0 | 0	0 | 0	0 | 0	0 | 0	0 | 0	0 | 0	0 | 0
14													
15													
16 Before Adj													
16 After Adj													

* NOTE: HORIZ REG → VERT BARS VERT REG → HORIZ BARS

TABLE 6.-2 EVLN DAY TABLE

SHEET 2 of 3

DATE: 12/1/[illegible] WITNESSED BY: GOVT [illegible] ([illegible])
LINK [illegible]
LIBRASCOPE [illegible]

HOUR NO. (CON'T)	TEST 5.6 RESOLUTION* FOCUS DIAL (DEG.)	HORIZ RES. (GROUP)	VERT RES. (GROUP)	ADJUSTMENTS MADE AT HOUR 9	ADJUSTMENTS MADE AT HOUR 16	COMMENTS
1	201° 39'	-1,4	-1,1	[illegible]		[illegible] TRIED TO CLEAN ARGON [illegible]
2	201° 30'	-1,4	-1,1	[illegible]		LASER OPTICS, WILL TRY NEW MIRROR TODAY.
3	~~[illegible]~~	~~[illegible]~~	~~[illegible]~~	[illegible]		AT 11:00 PUT IN NEW [illegible] MIRROR. TOOK THE [illegible]
4	201° 10'	-1,3	-1,1	[illegible] table -		[illegible]
5	201° 15'	-1,3	-1,1	[illegible]		Low VOLTAGE Power IN SP LASER supply unstable ([illegible])
6	201° 20'	-1,2	-1,1	[illegible]		
7	201° 27'	-1,3	-1,1	[illegible]		[illegible]
8	201° 23'	-1.1	-1.1	[illegible]		[illegible]
9 Before Adj	201° 20'	-1,2	-1.2	[illegible] to table.		Spectra Physics off center 6:23 Spinner off
9 After Adj	[illegible] 58'	-1.3	-1.2	this [illegible] signal.		
10	200° [illegible]	-1.3	-1.2	[illegible]		none
11	200° 57'	-1.3	-1.2	[illegible]		none
12	200° 57'	-1.3	-1.2	[illegible]		8:42 Spinner off
13	200° 34'	-1.3	-1.3	[illegible]		none
14	200° 52'	-1.3	-1.3	*Power output [illegible]		none
15	200° 53'	-1.3	-1.3	on [illegible] beam observed which is gone		12:03 Spectra Physics shutdown completely.
Before Adj.						
After Adj.						

*NOTE - Horiz Res ⇒ Vert Bars
Vert Res ⇒ Horiz Bards

TABLE 6.-2 EVEN DAY TABLE (CONT'D)

DATE 12-5-80 WITNESSED BY: GOV'T [illegible] (Monitor Only)
LINK [illegible]
LIBRASCOPE [illegible]

HOUR NO.	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PWR OUTPUT ARGON WATTS	ARGON AMPS	KRYPTON WATTS	KRYPTON AMPS	DYE WATTS	TEST 5.3 VIDEO LEVEL V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HI VOLTAGE (VOLTS)
1	8:30	120	68°/64	71%	See comments		270	29.5	See Comments	.7	See Comments		1200
2	930	120	67°/64	67%			250	29.5		.7			1200
3	10:30	120	70°/64	68%									
4	1130	120	70°/64°	68%			250	29.5		.375			1200
5	1230	120	69°/64°	67%									
6	130	120	69°/64°	67°									
7					See Comment					0.4			~~1200~~
8	1:30	122	68°/63°	71%									
9													
10													
11													
12													
13													
14													
15													
16 Before Adjust													
16 After Adjust													

TABLE 6.-1 ODD DAY TABLE

SHEET 1 of 3

DATE 12-5-80 WITNESSED BY: GOV'T Robt Ferguson (Monitor Only)
LINK [illegible]
LIBRASCOPE ____

HOUR NO. Cont'd	TEST 5.4 CENTER & SIZE					TEST 5.5 REGISTRATION							
						PT. A		PT. B		PT. C		PT. D	
	CENTER ↑+ └→+ (ARC-MIN)	LEFT +← (ARC-MIN)	RIGHT →+ (ARC-MIN)	TOP ↑+ (ARC-MIN)	BOTTOM ↓+ (ARC-MIN)	HORIZ* REG (ARC-MIN)	VERT* REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)
1	←	ST	ART	→	→	← SE	E	COMM	ENTS	→	→	→	→
2													
3													
4													
5	-4, +2	+2	-2	-2	+2								
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16 Before Adj													
16 After Adj													

* NOTE: HORIZ REG → VERT BARS VERT REG → HORIZ BARS

TABLE 6.-1 ODD DAY TABLE (CONT'D)

SHEET 2 of 3

DATE: 12/5/80 WITNESSED BY: GOVT [illegible] (Mister Daly)
LINK [illegible]
LIBRASCOPE M. Maure

HOUR NO. (CON'T)	TEST 5.6 RESOLUTION* FOCUS DIAL (DEG.)	HORIZ RES. (GROUP)	VERT RES. (GROUP)	ADJUSTMENTS MADE AT HOUR 16	COMMENTS
1	201° 10'	-1.4	1.2		RED ONLY ; The Spectra Physics argon laser power supply is not maintaining stable voltage regulation. The result is that a protect circuit shuts the laser down completely. A repairman will be here 12/7/80.
2	201° 15'	1.4	1.2		
3	201° 12'	1.4	1.2		
4	201° 30'	1.4	1.2		
5	201° 27'	1.4	1.2		
6	201° 35'	1.4	1.2		Red Only Operation [illegible] operation on for entire
7	~	~~1.3~~	~~1.2~~	~~None~~	period. Equipment shut down - DBL
8	201° 18'	1.3	1.2	None	
9					
10					
11					
12					
13					
14					
15					
16 Before Adj.					
After Adj.					

*NOTE - Horiz Res ⇒ Vert Bars,
Vert Res ⇒ Horiz Bars

TABLE 6.-1 ODD DAY TABLE (CON'T)

DATE 12/8/70 WITNESSED BY: GOV'T [illegible signature] (Metro Cal). LINK [illegible signature] LIBRASCOPE [illegible signature] / [illegible signature]

HOUR NO.		TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PWR OUTPUT ARGON WATTS	ARGON AMPS	KRYPTON WATTS	KRYPTON AMPS	DYE WATTS	TEST 5.3 VIDEO LEVEL V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HI VOLTAGE (VOLTS)
1		7:00	120	61°/63°	58%	4	27.5	.250	29	.220	.7	.7	.7	1200
2		8:00	120	67°/63°	50%									
3		9:00/9:15	120	68°/64°	58%	4	27.5	.220	29.5	.200	.7	.7	.7	1000
4		10:20/10:25	120	70°/63°	55%									
5		11:03/11:15	120	70°/62°	48%	4.0	27.2	.230	29.5	.230	.55	.5	.55	1200
6		12:00/12:05	120	70°/63°	50%									
7		1:29/1:35	120	68°/65°	50%	4	29	.220	29.5	.225	.5	.5	.5	1200
8		2:00	120	69°/63°	50%									
9	Before Adj	3:12/3:20	120	70°/62°	48%	3.9	28.5	.230	29.5	.235	.5	.5	.6	1200
	After Adj	3:40/3:48	121	70°/62°	55%	4.0	29.0	.240	29.5	.240	.7	.7	.7	1200
10		4:00	120	70°/62°	55%									
11		5:00	121	70°/63	48%	4.0	29.0	.230	29.5	.230	.7	.7	.7	1200
12		6:00	120	70°/64°	48%									
13		7:00	120	70/64°	44%	4.0	29.3	210	29.8	.230	.68	.7	.7	1200
14		8:00	121	70°/64	45%									
15		9:00	120	70/66	46%	4.0	29.5	.220	29.5	.240	.65	.7	.7	1200
16	Before Adjust	10:00	120	70/65	48%	4.0	29.5	.215	29.5	.240	.65	.7	.7	1200
	After Adjust													

TABLE 6.-2 EVEN DAY TABLE

Sheet 1 of 3

DATE 12/2/80 WITNESSED BY: GOV'T [illegible] (Monitor Only)
LINK [illegible]
LIBRASCOPE [illegible] / J. Barber

HOUR NO. Cont'd	TEST 5.4 CENTER & SIZE: CENTER ↑+ →+ (ARC-MIN)	LEFT +← (ARC-MIN)	RIGHT →+ (ARC-MIN)	TOP ↑+ (ARC-MIN)	BOTTOM ↓+ (ARC-MIN)	TEST 5.5 REGISTRATION: PT. A HORIZ* REG (ARC-MIN)	PT. A VERT* REG (ARC-MIN)	PT. B HORIZ REG (ARC-MIN)	PT. B VERT REG (ARC-MIN)	PT. C HORIZ REG (ARC-MIN)	PT. C VERT REG (ARC-MIN)	PT. D HORIZ REG (ARC-MIN)	PT. D VERT REG (ARC-MIN)
1	START					0 / 0	0 / 2	0 / 0	1 / 3	0 / 0	0 / 2	0 / 0	0 / 2
2													
3													
4													
5	+35 / +15	-30	+25	-5	0	0 / +2	5 / 8	0 / 0	+5 / +6	0 / 0	+5 / +5	+2 / +2	+5 / +5
6													
7													
8													
9 Before Adj	+50 / +20	-40	+40	0	-10	0 / +2	+5 / +5	0 / 0	+6 / +8	0 / +2	+5 / +5	+2 / +3	+5 / +6
9 After Adj	START					0 / -1	0 / 0	0 / 0	0 / 0	0 / -2	0 / 0	0 / -1	0 / 0
10													
11													
12													
13	0 / +15	~~+20~~ -15	+10	0	-5	0 / +5	0 / 0	-2 / -2	0 / 0	0 / 0	0 / 0	0 / +2	0 / 0
14													
15													
16 Before Adj	+25 / +15	-15	+15	0	0	0 / +5	0 / 0	0 / -5	0 / 0	0 / -3	0 / 0	0 / +2	0 / 0
16 After Adj													

* NOTE: HORIZ REG → VERT BARS VERT REG → HORIZ BARS

TABLE 6.-2 EVLN DAY TABLE

SHEET 2 of 3

DATE: 12/8/80 WITNESSED BY: GOVT [illegible signature]
LINK [illegible signature]
LIBRASCOPE [illegible signature]

HOUR NO. (CON'T)	TEST 5.6 RESOLUTION* FOCUS DIAL (DEG.)	HORIZ RES. (GROUP)	VERT RES. (GROUP)	ADJUSTMENTS MADE AT HOUR 9	ADJUSTMENTS MADE AT HOUR 16	COMMENTS
1	200° 15'	-1,3	-1,2			SYSTEM TURNED ON 6:00 AM. MORNING [illegible] START 6:30.
2	200° 21'	-1,2	-1,2			TEST START 7:00 AM.
3	200° 27'	1,2	-1,1			
4	200° 21'	1.2	1.1			[illegible]
5	200° 9'	-1,3	-2,6			VIDEO SIG. FLUTTER DUE TO TOP PERISCOPE MIRROR
6	199° 39'	-1,1	-2,4			
7						DELAY FOR 20 MIN FOR OUTSIDE UNRELATED [illegible]
8						[illegible] OUTSIDE UNRELATED MAINTENANCE
9 Before Adj	200° 30'	-1,3	-2,6			Bad Registration
9 After Adj	200° 20'	-1,4	-1,1	[illegible]		
10	200° 20'	-1,4	-1,1	[illegible] CHANNEL		
11	200° 30'	-1,3	-1,2			
12	200° 15'	-1,3	-1,2			
13	200° 15'	-1,3	-1,2			
14	200° 11'	-1,3	-1,2			
15	200° 0'	-1,3	-1,2			
Before Adj.	200° 15'	-1,2	-1,2		NONE [illegible]	10:10 SHUT DOWN
After Adj.						

*NOTE - Horiz Res → Vert Bars
Vert Res → Horiz Bards

TABLE 6.-2 EVEN DAY TABLE (CONT'D)

DATE 12/9/80 WITNESSED BY: GOV'T [illegible] (Monitor Only)
LINK [illegible]
LIBRASCOPE [illegible]

HOUR NO.	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PWR OUTPUT ARGON WATTS	ARGON AMPS	KRYPTON WATTS	KRYPTON AMPS	DYE WATTS	TEST 5.3 VIDEO LEVEL V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HT VOLTAGE (VOLTS)
1	7:50 / 7:55	120	67° / 62°	49%	4	30	.225	29.5	.220	.7	.65	.7	1200
2	8:00 / 8:10	120	68° / 63°	50%									
3	9:00 / 9:10	120	67° / 65°	50%	3.95	30	.225	29.5	.220	.63	.6	.7	1200
4	10:00 / 10:10	120	68/62	54%									
5	11:00 / 11:15	120	64/62°	50%	3.95	29.5	.225	28	.220	.6	.55	.7	1200
6	12:00 / 12:[illegible]	120	70/63°	48%									
7	[illegible]	120	64/63°	47%	3.9	29.5	.225	28	.230	.5	.35	.5	1200
8	2:00 / 2:10	120	69° / 63°	51%									
9	3:[illegible] / 3:10	120	64/65°	57%	3.9	29.5	.240	29	.230	.5	.4	.5	1200
9	3:[illegible]	120	64/63	58%	4.0	30.0	.235	29	.230	.65	.7	.7	1200
10	4:00	120	64/63	57%									
11	[illegible]	120	65/[illegible]	52%	4.0	30.0	.230	29	.230	.65	.75	.70	1200
12	6:00	120	70/64°	42%									
13	7:00	121	70/64°	45%	4.0	30.0	.225	28.5	.225	.65	.70	.65	1200
14	[illegible]	121	70/63	42%									
15	[illegible] / 9:20	120	70/63	48%	4.0	30.0	.230	29	.225	.65	.7	.65	1200
15 Before Adjust	[illegible] / 10:00	121	70/63	42%	4.0	30.0	.225	29	.225	.65	.70	.65	1200
After Adjust													

019

DATE 12/9/80 WITNESSED BY: GOV'T ______ LINK A. Chands[?] LIBRASCOPE [illegible]

HOUR NO. Cont'd	TEST 5.4 CENTER & SIZE						TEST 5.5 REGISTRATION															
							PT. A				PT. B				PT. C				PT. D			
	CENTER ↑+ →+ (ARC-MIN)		LEFT +← (ARC-MIN)	RIGHT →+ (ARC-MIN)	TOP ↑+ (ARC-MIN)	BOTTOM ↓+ (ARC-MIN)	HORIZ* REG (ARC-MIN)		VERT* REG (ARC-MIN)		HORIZ REG (ARC-MIN)		VERT REG (ARC-MIN)		HORIZ REG (ARC-MIN)		VERT REG (ARC-MIN)		HORIZ REG (ARC-MIN)		VERT REG (ARC-MIN)	
	X	Y					RG	KB	RG	KB	RG	KB	RG	KB	RG	KB	RG	KB	RG	KB	RG	KB
1	←		START			→	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0
2																						
3																						
4							0	0	+1	0	+1	0	+2	+2	+2	0	0	0	+1	+1	+2	0
5	+35	-5	-25	+25	-5	+10																
6																						
7																						
8	+30	+10	-30	+30	-5	+15	0	0	+4	+4	-1	-1	+4	+4	0	0	+3	+3	0	0	+3	+3
9	+40	+10	-30	+30	-5	+15	0	0	+4	+4	-1	-1	+4	+4	0	0	+3	+3	0	0	+3	+3
10																						
11																						
12							-3	-2	0	0	0	-3	0	0	-2	-2	0	0	0	0	+2	0
13	+28	+10	-30	+25	0	-10																
14																						
15							0	0	0	0	0	-3	0	0	-2	-2	0	0	-1	-2	+2	0
16 Before Adj	15	+10	-35	+30	0	-15																
After Adj																						

* NOTE: HORIZ REG → VERT BARS VERT REG → HORIZ BARS

TABLE 6.-1 ODD DAY TABLE (CONT'D)

SHEET 2 of 3

DATE: 12/9/83 WITNESSED BY: GOVT [illegible] (Monitor Only)
LINK [illegible]
LIBRASCOPE [illegible]

HOUR NO. (CON'T)	TEST 5.6 RESOLUTION* FOCUS DIAL (DEG.)	HORIZ RES. (GROUP)	VERT RES. (GROUP)	ADJUSTMENTS MADE AT HOUR 16	COMMENTS
1	200° 34'	-1.3	-1.2		
2	200° 19'	-1.3	-1.2		Intermittent flashing [illegible] faster [illegible]
3	200° 15'	-1.4	-1.2		
4	200° 19'	-1,4	-1,2		
5	199° 42'	-1,3	-1,1		
6	200° 6'	-1,3	-1,2		
7	200° 27'	-1,3	-2,6		REGISTRATION BAD IN VERTICAL GREEN V. SIGNAL LOW
8	200° 15'	-1.2	-2 6		
9 bef	200° 14'	-1,3	-2,6	ADJUST PERISCOPE MIRROR [illegible]	Registration very bad. We felt it not [illegible] to continue in that state.
aft	200° 14'	-1,3	-1,1	RESET PRECOMP GRID GREEN & BLUE	Installed Beam angle Servo
10	[illegible] 9'	-1,4	-1,1		
11	200° 8'	-1,5	-1,1		
12	200° 6'	-1,3	-1,2		
13	199° 52'	-1.4	-1.1		
14	[illegible] 13'	-1.5	-1.[illegible]		
15	[illegible] 3'	-1.3	-1.[illegible]		
16 Before Adj.	19[illegible] 5[illegible]'	-1.[illegible]	1.1	NONE NECESSARY	[illegible]
After Adj.					

*NOTE - Horiz Res → Vert Bars, Vert Res → Horiz Bars

TABLE 6.-1 ODD DAY TABLE (CON'T)

SHEET 3 of 3

DATE 12-10-80 WITNESSED BY: GOV'T Robert Ferguson (Monit Only)
LINK [illegible]
LIBRASCOPE John Borders

HOUR NO.	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PWR OUTPUT ARGON WATTS	ARGON AMPS	KRYPTON WATTS	KRYPTON AMPS	DYE WATTS	TEST 5.3 VIDEO LEVEL V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HI VOLTAGE (VOLTS)
1	8:00 / 8:15	120	68/63	54%	4	31.5	.230	29.5	.220	.7	.7	.7	1200
2	9:00	120	68/63	50%	4	31	.220	29	.220	.75	.65	.7	1200
3	10:00	120	68/65	50%									
4	1:00	120	69/63	48%	4	31	.220	29	.220	.7	.6	.7	1200
5	2:00 / 2:15	120	70/65	45%									
6		120	[illegible]/63	[illegible]	39.5	31	.220	29	.220	.7	.5	.6	1200
7	[illegible]	120	74/64	45%									
8	[illegible]	121	72/64	41%	3.55	31	.220	29	.220	.7	.4	.7	1200
9 Before Adj	4-?PM	122	7?/6?	4?%									
9 After Adj													
10			Trouble found										
11			Argon Laser Instability										
12			Due to low [illegible] - maybe Argon [illegible] stability										
13					~~4.0~~	~~30.0~~	~~.225~~	~~27.5~~	~~.215~~	.7	.7	.7	~~1200~~
14	1:00	121	71/66	45%	4.0	30.0	.210	27.5	.225	.7	.7	.7	1200
15	10:00	121	71/66	43%	4.0	30.0	.215	27.5	.215	.6	.7	.7	12.0
16 Before Adjust	11:[illegible]	121	72/66	43%									
16 After Adjust													

TABLE 6.-2 EVEN DAY TABLE

DATE 12-10-90 WITNESSED BY: GOV'T ____________
LINK [signature]
LIBRASCOPE John Borden

HOUR NO. Cont'd	TEST 5.4 CENTER & SIZE					TEST 5.5 REGISTRATION															
	CENTER (ARC-MIN)	LEFT +← (ARC-MIN)	RIGHT →+ (ARC-MIN)	TOP ↑+ (ARC-MIN)	BOTTOM ↓+ (ARC-MIN)	PT. A HORIZ* REG (ARC-MIN) RG	PT. A HORIZ* REG (ARC-MIN) BG	PT. A VERT* REG (ARC-MIN)		PT. B HORIZ REG (ARC-MIN)		PT. B VERT REG (ARC-MIN)		PT. C HORIZ REG (ARC-MIN)		PT. C VERT REG (ARC-MIN)		PT. D HORIZ REG (ARC-MIN)		PT. D VERT REG (ARC-MIN) RG	PT. D VERT REG (ARC-MIN) BG
1	←	STA	RT	→	→	0	0	0	0	0	-1	0	+1	-2	0	0	-1	0	0	0	0
2																					
3																					
4																					
5	30, 0	-20	+20	-5	~~-10~~ -5	0	0	+5	0	0	+5	-5	0	0	+5	-5	0	0	+1	+1	+1
6																					
7																					
8																					
9 Before Adj	[illegible]	-10	+10	+10	-10	0	0	+5	0	0	0	+5	0	0	+5	-5	0	0	+1	+1	+1
9 After Adj		[illegible]																			
10																					
11																					
12																					
13																					
14																					
15																					
16 Before Adj	[illegible] +5	[illegible]	[illegible]			0	0	0	+5	0	0	0	+3	0	0	0	0	0	0	+1	+1
16 After Adj																					

* NOTE: HORIZ REG → VERT BARS VERT REG → HORIZ BARS

TABLE 6.-2 EVLN DAY TABLE

SHEET 2 of 3

DATE: 12-10-80 WITNESSED BY: GOVT ______

LINK [illegible signature]

LIBRASCOPE [illegible signature]

HOUR NO. (CON'T)	TEST 5.6 RESOLUTION* FOCUS DIAL (DEG.)	HORIZ RES. (GROUP)	VERT RES. (GROUP)	ADJUSTMENTS MADE AT HOUR 9	ADJUSTMENTS MADE AT HOUR 16	COMMENTS
						Boom Angle Servo Adj. [illegible]
1	200° 58'	-1.4	-1.2			(VIDEO LEVELS DROPPED
2	200° 39'	-1.4	1.2			TO .3 V overnight)
3	200° 28'	-1,4	-1,1			
4	200° 15'	-1,3	-1,1			
5	200° 42'	-1.4	-1.1			
6	54'	[illegible]	1.1			
7	200° 42'	-1,4	-1,1			
8	200° 41'	-1,3	-2,5			Finally [illegible]
9 Before Adj	200° 30'	-1,3	-1.1	Adjusted [illegible]		[illegible]
9 After Adj				Checked Tube [illegible]		[illegible] 8:35
10				[illegible] attempting to converge		[illegible]
11				[illegible]		[illegible]
12				[illegible] at [illegible]		
13						[illegible]
14	200° 20'	-1,2	-1,2			[illegible]
15	200° 0'	-1,3	-1,2			Small [illegible]
Before Adj.	200° 11'	-1,3	1,2			[illegible]
After Adj.	Not	Performed				

SHEET 3 of 3

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*NOTE - Horiz Res ⇒ Vert Bars
Vert Res ⇒ Horiz Bards

TABLE 6.-2 EVEN DAY TABLE (CONT'D)

DATE 12-11-80 WITNESSED BY: GOV'T: [illegible] monitored
LINK [illegible]
LIBRASCOPE [illegible]

HOUR NO.	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PWR OUTPUT ARGON WATTS	ARGON AMPS	KRYPTON WATTS	KRYPTON AMPS	DYE WATTS	TEST 5.3 VIDEO LEVEL V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HT VOLTAGE (VOLTS)
1	8:19 / [illegible]	120	69/65	55%	4	30	.235	29	.230	.7	.7	.7	1200
2	9:19 / 9:30	120	70/65	48%	4	30	.225	29	.220	.7	.7	.7[illegible]	1200
3	10 / 10:00	120	70/66	44%						.6	.65	.7	1200
4	11:00	120	71/65	45%	4	30	.225	29	.220				
5	12:00	120	72/66	42%						.7	.6	.6	1200
6	1[illegible]	[illegible]	[illegible]	44%	4	30	.220	29	.220				
7		120	72/[illegible]	49%									
8	3:10	[illegible]	[illegible]/66	49%						.65	.6	.7	1200
9	4:10	120	72/65	49%	4	30	.225	29	.230				
10	[illegible]	120	72/65	49%						.65	.6	.7	1200
11	6:10	120	72/66	42%	4	30	.215	29	.225				
12	7:[illegible]	120	72/65	49%					.220	.65	.7	.75	1200
13	8:[illegible]	120	72/66	49%	4	30	.210	29				.75	1200
14	[illegible]	[illegible]	[illegible]/66	4[illegible]%	4	31	.210	29	.220	.7	.7	.7	1200
15	[illegible]	120	72/66	42%	4	31	.205	29	.220	.7	.7	.7	1200
Before Adjust	[illegible]	120	71	49%									
After Adjust													

DATE 12-11-80 WITNESSED BY: GOV'T ______
LINK [signature]
LIBRASCOPE [signature]

HOUR NO. Cont'd	TEST 5.4 CENTER & SIZE					TEST 5.5 REGISTRATION															
						PT. A				PT. B				PT. C				PT. D			
	CENTER ↑+ └→+ (ARC-MIN)	LEFT +← (ARC-MIN)	RIGHT →+ (ARC-MIN)	TOP ↑+ (ARC-MIN)	BOTTOM ↓+ (ARC-MIN)	HORIZ* REG (ARC-MIN)		VERT* REG (ARC-MIN)		HORIZ REG (ARC-MIN)		VERT REG (ARC-MIN)		HORIZ REG (ARC-MIN)		VERT REG (ARC-MIN)		HORIZ REG (ARC-MIN)		VERT REG (ARC-MIN)	
1	←	START	→			0	0	0	0	-2	1	0	1	-2	0	0	0	0	0	+2	0
2																					
3																					
4						0	1	0	0	0	-1	-2	0	-2	0	0	-1	0	-1	+2	-2
5	+1, 0	+2	-3	0	0																
6																					
7																					
8						0	0	0	0	0	0	-2	0	0	0	0	0	0	0	+2	0
9	+8, +4	-5	+4	0	0																
10																					
11																					
12						0	0	+4	0	0	0	+4	0	0	0	0	0	-2	0	0	0
13	11, 15	-15	0	-5	-+5																
14																					
15						-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1
16 Before Adj	+8, 0	-15	0	-5	0																
16 After Adj																					

* NOTE: HORIZ REG → VERT BARS VERT REG → HORIZ BARS

TABLE 6.-1 ODD DAY TABLE (CONT'D)

SHEET 2 of 3

DATE: 12-11-86 WITNESSED BY: GOVT ______
LINK [illegible signature]
LIBRASCOPE [illegible signature]

HOUR NO. (CON'T)	TEST 5.6 RESOLUTION* FOCUS DIAL (DEG.)	HORIZ RES. (GROUP)	VERT RES. (GROUP)	ADJUSTMENTS MADE AT HOUR 16	COMMENTS
1	200° 48'	-1.4	-1.2		
2	200° 51'	-1.4	-1.2		
3	200° 18'	-1.3	-1.2		
4	200° 42'	-1.3	-1.1		
5	200° 0'	-1.3	-1.1		
6	[illegible]	-1.2	1.1		
7	[illegible] 23'	-1.3	-1.2		
8	[illegible]	[illegible]	-1.1		
9	200° 2'	-1,3	-1,1	~~A~~	
10	200° 25'	-1,3	-1,1		
11	200° 15'	-1.3	-1.2		Readj top periscope mirror to [illegible] lines
12	200° 6'	-1,3	-1,1		
13	200° 28'	-1.4	-1.1		
14	200° 33'	-1.4	-1.2		
15	[illegible]	-1.4	[illegible]	Nr 16	SHUT DOWN 11:01
16 Before Adj.	200° 30'	-1.3	-1.2		
After Adj.					

*NOTE - Horiz Res ⇒ Vert Bars,
Vert Res ⇒ Horiz Bars

TABLE 6.-1 ODD DAY TABLE (CON'T)

DATE 12/12/80 WITNESSED BY: GOV'T ______
LINK ______
LIBRASCOPE [illegible]

HOUR NO.	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PWR OUTPUT					TEST 5.3 VIDEO LEVEL			
					ARGON		KRYPTON		DYE	V SIGNAL	V SIGNAL	V SIGNAL	HI
					WATTS	AMPS	WATTS	AMPS	WATTS	RED (VOLTS)	GREEN (VOLTS)	BLUE (VOLTS)	VOLTAGE (VOLTS)
1	[illegible]	120	70	45%	4	31.5	.235	24	~~.210~~ .185	.7	.7	.7	1200
2		[illegible]	[illegible]	[illegible]									
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	31	.235	24	.185	.7	.7	.8	[illegible]
4	[illegible]	120	[illegible]	[illegible] %									
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	31	[illegible]	24	.170	.7	.7	[illegible]	[illegible]
6		[illegible]	[illegible]	[illegible]									
7	[illegible]	120	72/66	42%	4	.31	.255	24.5	.18	.7	.6	.6	1200
8	[illegible]	[illegible]	72/66	42%									
9 Before Adj	[illegible]	[illegible]	72/66	[illegible]	4	32	.260	25	.180	.65	.7	.7	[illegible]
9 After Adj													
10													
11			[illegible]	[illegible]									
12				[illegible]									
13													
14													
15													
16 Before Adjust													
16 After Adjust													

TABLE 6.-2 EVEN DAY TABLE

Sheet 1 of 3

DATE 12-12-80 WITNESSED BY: GOV'T [illegible signature]
LINK
LIBRASCOPE [illegible signature]

HOUR NO. Cont'd	TEST 5.4 CENTER & SIZE: CENTER (ARC-MIN)	LEFT +← (ARC-MIN)	RIGHT →+ (ARC-MIN)	TOP ↑+ (ARC-MIN)	BOTTOM ↓+ (ARC-MIN)	TEST 5.5 REGISTRATION: PT. A HORIZ* REG (ARC-MIN)	PT. A VERT* REG (ARC-MIN)	PT. B HORIZ REG (ARC-MIN)	PT. B VERT REG (ARC-MIN)	PT. C HORIZ REG (ARC-MIN)	PT. C VERT REG (ARC-MIN)	PT. D HORIZ REG (ARC-MIN)	PT. D VERT REG (ARC-MIN)
						RG BG	RG BB						
1		START		—		0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0
2													
3													
4													
5	1	0	-2	0	0	0 0	1 0	1 [illegible]	1 [illegible]	0 0	0 [illegible]	[illegible]	[illegible]
6													
7													
8													
9 Before Adj	1 2	-1	+2	0	0	+1 0	+1 +4	+4 +4	0 +4	+1 +4	+4 +4	0 +1	+1 +4
9 After Adj													
10													
11													
12													
13													
14													
15													
16 Before Adj													
16 After Adj													

* NOTE: HORIZ REG → VERT BARS VERT REG → HORIZ BARS

TABLE 6.-2 EVEN DAY TABLE

SHEET 2 of 3

DATE: 12/12/82 WITNESSED BY: GOVT

LINK

LIBRASCOPE [illegible]

HOUR NO. (CON'T)	TEST 5.6 RESOLUTION* FOCUS DIAL (DEG.)	HORIZ RES. (GROUP)	VERT RES. (GROUP)	ADJUSTMENTS MADE AT HOUR 9	ADJUSTMENTS MADE AT HOUR 16	COMMENTS
1		[illegible]	[illegible]			
2	[illegible]		-1 3			
3	[illegible]	1	1 2			
4	[illegible]	[illegible]	[illegible]			
5	[illegible]	[illegible]	[illegible]			
6	[illegible]	[illegible]	-1 2			
7	200° 14'	-1 3	-1,1			[illegible]
8	200° 32'	-1,2	-1,1			[illegible]
9 Before Adj	[illegible] 31'	-1,2	-1,1			[illegible]
9 After Adj						[illegible]
10						[illegible]
11						[illegible]
12						[illegible]
13						[illegible]
14						[illegible]
15						[illegible]
16 Before Adj.						[illegible]
16 After Adj.						[illegible]

*NOTE - Horiz Res ⇒ Vert Bars
Vert Res ⇒ Horiz Bards

TABLE 6.-2 EVEN DAY TABLE (CONT'D)